World Journal of Gastrointestinal Endoscopy

Online Submissions: http://www.wjgnet.com/1948-5190office
wjge@wjgnet.com
doi:10.4253/wjge.v3.i4.67

World J Gastrointest Endosc 2011 Aril 16; 3(4): 67-70
ISSN 1948-5190 (online)

EDITORIAL

Management of complications following endoscopic submucosal dissection for gastric cancer

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Received: November 27, 2010 Revised: February 17, 2011
Accepted: February 24, 2011
Published online: April 16, 2011

Abstract

Endoscopic treatment should be considered for early gastric cancer (EGC) and gastric precancerous lesions. Endoscopic submucosal dissection (ESD) was developed for en bloc removal of a large gastric neoplasm and has been developed following improvements in electrical equipment for hemostasis and dissection and with advances in various knives, hemostatic forceps and endoscopic equipment. ESD is currently the treatment of choice for precancerous lesions or EGC showing mucosal invasion. Hemorrhage and perforation are major complications of ESD for EGC. We describe the complication of ESD procedures in gastric lesions for endoscopists who are relatively inexperienced in ESD and who may lack optimal access to ESD education and facilities.

Key words: Endoscopic submucosal dissection; Gastric cancer, Perforation; Bleeding

Peer reviewers: Jaekyu Sung, MD, PhD, Assistant Professor, Division of Gastroenterology, Department of Internal Medicine, Chungnam National University Hospital, 33 Munhwa-ro, Jung-gu, Daejeon 301-721, South Korea; Takeshi Nakajima, MD, PhD, Endoscopy Division, National Cancer Center Hospital, 5-1-1 Tsukiji, Chuo-ku, Tokyo 104-0045, Japan

Kim YJ, Park DK. Management of complications following endoscopic submucosal dissection for gastric cancer. *World J Gastrointest Endosc* 2011; 3(4): 67-70 Available from: URL: http://www.wjgnet.com/1948-5190/full/v3/i4/67.htm DOI: http://dx.doi.org/10.4253/wjge.v3.i4.67

INTRODUCTION

The incidence of gastric cancer is high in Japan, Korea and China. Periodic endoscopy should be performed. Endoscopic treatment should be considered for early gastric cancer (EGC) and gastric precancerous lesions. Endoscopic submucosal dissection (ESD) has been developed following improvements in electrical equipment for hemostasis and dissection and with advances in various knives, hemostatic forceps and endoscopic equipment. ESD is currently the treatment of choice for precancerous lesions or EGC showing mucosal invasion[1,2].

Professional endoscopic skill, experience with the electronic equipment, knowledge of the appropriate application of diverse knives and skillful endoscopy assistants are required to achieve positive outcomes with ESD. Even when these conditions are met, complications such as hemorrhage, perforation, pneumothorax, aspiration pneumonia, cardiopulmonary complication, abdominal pain and fever can occur. The endoscopist must possess sufficient knowledge to address such complications promptly and appropriately. A thorough knowledge of the indicators for ESD and the factors causing these complications is also important. Hemorrhage is a complication in 10%-20% of ESDs[3] and perforation in 5%[4]; most of these cases can be overcome, however, through skilled execution of the endoscopic procedure[5]. The en bloc resection rate for EGC is nearly 80%, depending on the location and size of the lesion; such resection prevents recurrence of the cancer in nearly all cases[6,7]. These data were collected at large-scale hospitals for the preparation of ESD educational curricula and primarily include pro-

cedures performed with ample access to the most advanced equipment, skillful endoscopy care teams and gastrointestinal specialists.

A rapidly increasing number of physicians are entering the field of endoscopy and many hospitals are opening new endoscopy facilities. However, most have inadequate educational systems and endoscopic equipment. Although many academic meetings and workshops have sought to address these problems, the tremendous and rapidly increasing demands are difficult to meet. In this context, we present our opinions and suggestions for the management of hemorrhage and perforation complications of ESD in this article. We hope that this discussion may benefit endoscopists who are relatively inexperienced in ESD for stomach lesions and who may lack optimal access to ESD education and facilities.

HEMORRHAGE

During ESD, the endoscopist must identify the blood vessels most likely to hemorrhage and treat them effectively to stop the hemorrhage while dissecting the submucosa. ESD must not be attempted on a lesion affecting vessels in which an endoscopist cannot consistently stop bleeding in gastrointestinal hemorrhage patients. Hemostasis is usually most difficult in the upper stomach due to the broad distribution of large blood vessels and re-bleeding occurs readily in this location when the gastrointestinal tract bleeds. Oda *et al* reported that only location (upper and middle third) and size (≥ 31 mm) were associated with immediate bleeding[8]. In one report, younger age and the location of the lesions (upper and middle third) were associated with a higher frequency of immediate bleeding[9]. Bleeding can be somewhat reduced in areas with abundant blood vessels by strengthening the coagulation energy when precutting or dissection, but this increases the risk of perforation. Thus, the degree of mucosal elevation following submucosal dissection should be assessed carefully. During ESD, the endoscopist should not waste time attempting to achieve hemostasis or control minor bleeding, and should not interfere with complete incision by applying a clip. Dissection of lesions itself has an effect of hemostasis and is a help for obtaining sight.

In 4%-6% of cases, delayed bleeding occurs 24 h or more after ESD and can have serious consequences[10]. Delayed bleeding frequently follows ESD performed on large and flat lesions in the upper stomach[11]. Even in cases where no bleeding is observed after complete resection, additional coagulation can reduce the risk of delayed bleeding[12]. However, this process can occasionally cause delayed perforation[13]. When almost no submucosal layer remains and the muscle is properly exposed, it is not necessary to practice preventive hemostasis. Bleeding following the resection of lesion should be addressed using light lifting with hemostatic forceps to reduce muscle damage. The attempt to achieve hemostasis in coagulation mode by pressing the lesion, such as in ulcers, is associated with a very high risk of perforation. For patients at risk of delayed bleeding, insertion of an L-tube after the procedure will allow any such bleeding to be discovered and addressed immediately.

Most bleeding after ESD can be treated with an endoscopic procedure using an electronic knife, a hemoclip, argon plasma coagulation and hemostatic forceps. If the hemostasis is delayed due to difficult lesion or incomplete field of view, cardiopulmonary instability might occur in the patient. In this situation, it is important not to hesitate to carry out emergency surgery or embolization.

Patients with chronic renal failure or liver cirrhosis and recipients of subtotal gastrectomies are at high risk of acute and/or delayed bleeding. Because a patient's condition can deteriorate suddenly during bleeding, novice endoscopists should not attempt endoscopic procedures to treat hemorrhage. Patients who take anticoagulants or antiplatelet agents for lower risk cardiovascular or cerebrovascular disease should stop these medications 1 wk before an endoscopic procedure to reduce the risk of bleeding[14].

PERFORATION

In one report, location in the middle portion of the stomach ($P = 0.028$) and an elevated lesion ($P = 0.0477$) were significantly associated with the development of a perforation[15]. Appropriate use of high-frequency electronic equipment and instruments and the administration of sufficient submucosal injections are necessary to prevent perforation. The degree of submucosal injection should be evaluated during dissection; if mucosal elevation is insufficient, additional injection is necessary. If a patient complains of pain during ESD or hemostatic procedures, muscle involvement is possible and the direction of incision or degree of visibility may require correction. The use of sodium hyaluronate allows the elevation of the lesion to be maintained for a longer period of time, aiding dissection[16].

If perforation occurs and demands the attention of the endoscopist before lesion dissection, complete resection will be impossible and a subsequent surgical procedure will be required. A strategic approach is thus necessary. Most perforation can be addressed with a hemoclip but this instrument may make it difficult to obtain a sufficient resection margin or perform en bloc resection. Thus, it is desirable to apply clips to perforated areas after an incision or exfoliation has been performed and sufficient space for complete resection has been created. If the perforated area is large or the incision or exfoliation takes too long, pneumoperitonium can cause serious secondary problems such as respiratory failure, decreased blood pressure or increased abdominal pain. Centesis should thus be performed with an 18-20 gauge puncture needle to remove air from the abdominal cavity and to provide sufficient time for a complete resection attempt[17].

Although clipping is the most common treatment for perforation, a hemoclip can obscure visibility of structur-

es such as the gastroesophageal junction and the posterior wall of the upper gastric body. Band ligation may thus be a preferable treatment option[18]. Additionally, a clip may not encompass a wide perforation; in such cases, suction of the omentum can be applied to aid the clipping of the perforated area. When the omentum is not sucked after clipping of the perforation margins, clips on opposite sides of the perforation may be tied together with a detachable snare to treat a large perforation.

Following endoscopic treatment of a perforation, the patient may have leukocytosis, tenderness and/or a slight fever for 1-2 d. Most perforations that occur during ESD can be treated conservatively with the administration of antibiotics; few cases require surgical operation[19]. Because the conditions of the elderly, immunocompromised or chronic-disease patients may be exacerbated by perforation, careful observation of these patients is necessary and abdominal computed tomography (CT) scans should be performed if peritonitis is suspected. A surgical operation should be performed in cases of peritonitis.

Although pneumothorax is a rare complication, it can lead to death if appropriate measures are not taken promptly. Perforation of esophageal, gastroesophageal junction or fundus lesions can occur with respiration or sudden movement during precutting and may cause pneumoperitonium and pneumothorax simultaneously[20]. Because sudden respiratory failure may occur in such cases, all procedures should be stopped and the insertion of a chest tube into the pleural space should be considered. A novice endoscopist should consider the difficulty of each procedure and the risks of bleeding and perforation and transfer difficult or risky cases to a specialist endoscopy center. This is particularly true for lesions of the gastroesophageal junction, cardia and fundus. Expert endoscopists should also consider operating on such lesions under general anesthesia to control the movement and breathing of the patient, especially when the lesions are large.

ESD is an attractive and effective treatment for gastric cancer. Complications such as bleeding, perforation and incomplete resection may occur but can be minimized with the development of the endoscopist's skill and the use of advanced equipment. Realistically, however, opportunities to learn and practice ESD and use optimal equipment are often limited. We recommend the implementation of an appropriate educational system. The ability of the endoscopist to perform a procedure, the condition of available equipment and instrumentation, the position and size of the lesion, the health of the patient and the limitations of ESD should all be considered when evaluating the use of this procedure.

REFERENCES

1 **Ohkuwa M**, Hosokawa K, Boku N, Ohtu A, Tajiri H, Yoshida S. New endoscopic treatment for intramucosal gastric tumors using an insulated-tip diathermic knife. *Endoscopy* 2001; **33**: 221-226

2 **Ono H**, Kondo H, Gotoda T, Shirao K, Yamaguchi H, Saito D, Hosokawa K, Shimoda T, Yoshida S. Endoscopic mucosal resection for treatment of early gastric cancer. *Gut* 2001; **48**: 225-229

3 **Oka S**, Tanaka S, Kaneko I, Mouri R, Hirata M, Kawamura T, Yoshihara M, Chayama K. Advantage of endoscopic submucosal dissection compared with EMR for early gastric cancer. *Gastrointest Endosc* 2006; **64**: 877-883

4 **Isomoto H**, Shikuwa S, Yamaguchi N, Fukuda E, Ikeda K, Nishiyama H, Ohnita K, Mizuta Y, Shiozawa J, Kohno S. Endoscopic submucosal dissection for early gastric cancer: a large-scale feasibility study. *Gut* 2009; **58**: 331-336

5 **Minami S**, Gotoda T, Ono H, Oda I, Hamanaka H. Complete endoscopic closure of gastric perforation induced by endoscopic resection of early gastric cancer using endoclips can prevent surgery (with video). *Gastrointest Endosc* 2006; **63**: 596-601

6 **Isomoto H**, Ohnita K, Yamaguchi N, Fukuda E, Ikeda K, Nishiyama H, Akiyama M, Ozawa E, Nakao K, Kohno S, Shikuwa S. Clinical outcomes of endoscopic submucosal dissection in elderly patients with early gastric cancer. *Eur J Gastroenterol Hepatol* 2010; **22**: 311-317

7 **Park JC**, Lee SK, Seo JH, Kim YJ, Chung H, Shin SK, Lee YC. Predictive factors for local recurrence after endoscopic resection for early gastric cancer: long-term clinical outcome in a single-center experience. *Surg Endosc* 2010; **24**: 2842-2849

8 **Oda I**, Gotoda T, Hamanaka H, Eguchi T, Saito Y, Matsuda T, Bhandari P, Emura F, Saito D, Ono H. Endoscopic submucosal dissection for early gastric cancer: technical feasibility, operation time and complications from a large consecutive series. *Digestive Endoscopy* 2005; **17**: 54-58

9 **Jeon SW**, Jung MK, Cho CM, Tak WY, Kweon YO, Kim SK, Choi YH. Predictors of immediate bleeding during endoscopic submucosal dissection in gastric lesions. *Surg Endosc* 2009; **23**: 1974-1979

10 **Okada K**, Yamamoto Y, Kasuga A, Omae M, Kubota M, Hirasawa T, Ishiyama A, Chino A, Tsuchida T, Fujisaki J, Nakajima A, Hoshino E, Igarashi M. Risk factors for delayed bleeding after endoscopic submucosal dissection for gastric neoplasm. *Surg Endosc* 2011; **25**: 98-107

11 **Chung IK**, Lee JH, Lee SH, Kim SJ, Cho JY, Cho WY, Hwangbo Y, Keum BR, Park JJ, Chun HJ, Kim HJ, Kim JJ, Ji SR, Seol SY. Therapeutic outcomes in 1000 cases of endoscopic submucosal dissection for early gastric neoplasms: Korean ESD Study Group multicenter study. *Gastrointest Endosc* 2009; **69**: 1228-1235

12 **Takizawa K,** Oda I, Gotoda T, Yokoi C, Matsuda T, Saito Y, Saito D, Ono H. Routine coagulation of visible vessels may prevent delayed bleeding after endoscopic submucosal dissection--an analysis of risk factors. *Endoscopy* 2008; **40**: 179-183

13 **Fujishiro M**, Yahagi N, Kakushima N, Kodashima S, Muraki Y, Ono S, Yamamichi N, Tateishi A, Oka M, Ogura K, Kawabe T, Ichinose M, Omata M. Outcomes of endoscopic submucosal dissection for colorectal epithelial neoplasms in 200 consecutive cases. *Clin Gastroenterol Hepatol* 2007; **5**: 678-683; quiz 645

14 **Anderson MA**, Ben-Menachem T, Gan SI, Appalaneni V, Banerjee S, Cash BD, Fisher L, Harrison ME, Fanelli RD, Fukami N, Ikenberry SO, Jain R, Khan K, Krinsky ML, Lichtenstein DR, Maple JT, Shen B, Strohmeyer L, Baron T, Dominitz JA. Management of antithrombotic agents for endoscopic procedures. *Gastrointest Endosc* 2009; **70**: 1060-1070

15 **Akasaka T**, Nishida T, Tsutsui S, Michida T, Yamada T, Ogiyama H, Kitamura S, Ichiba M, Komori M, Nishiyama O, Nakanishi F, Zushi S, Nishihara A, Iijima H, Tsujii M, Hayashi N. Short-term outcomes of endoscopic submucosal dissection (ESD) for early gastric neoplasm: multicenter survey by osaka university ESD study group. *Digestive Endoscopy* 2011; **23**: 73-77

16 **Yamamoto H**, Kawata H, Sunada K, Satoh K, Kaneko Y, Ido K, Sugano K. Success rate of curative endoscopic mucosal

resection with circumferential mucosal incision assisted by submucosal injection of sodium hyaluronate. *Gastrointest Endosc* 2002; **56**: 507-512
17 **Messmann H**, Probst A. Management of endoscopic submucosal dissection complications. *Endoscopy* 2009; **41**: 712-714
18 **Lee HN**, Kim EJ, Park SK, Seo MR, Lee JJ, Lee YJ, Oh KY, Park DG. A Case of a Successful Band Ligation of a Colonic Perforation during Diagnostic Colonoscopy. *Korean J Gastrointest Endosc* 2010; **41**: 176-179
19 **Teoh AY**, Chiu PW, Wong SK, Sung JJ, Lau JY, Ng EK. Difficulties and outcomes in starting endoscopic submucosal dissection. *Surg Endosc* 2010; **24**: 1049-1054
20 **Jang CS**, Park DK, Kwon KA, Yu SK, Kim YK. Pneumothorax as a complication of ESD. *Endoscopy* 2007; **39** Suppl 1: E59

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