REVIEW ARTICLE

Endoscopic mechanical hemostasis of GI arterial bleeding (with videos)

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An increasing body of evidence is available on the use of endoscopic clips, loops, and bands in the treatment of GI bleeding. This review provides a summary of the mechanical endoscopic hemostatic devices and the techniques used in the management of GI arterial bleeding.

REVIEW METHOD

A MEDLINE search of English language publications was performed from 1966 to October 2006 related to endoscopic mechanical hemostasis by using the key words ''endoclip,'' ''hemoclip,'' ''band ligation,'' and ''endoloop.'' Additionally, a manual search of *Gastrointestinal Endoscopy* and *Endoscopy* from 1994 to October 2006 for published articles on this subject was performed. Reference lists from relevant articles were also inspected to identify additional applicable articles missed with the above search strategy. An overall quality assessment of the available publications was done according to ''Evidence based gastroenterology and hepatology'' (see Appendix). Recommendation grades for the use of endoscopic hemostatic devices appear within the text as follows: (**Recommendation [R]** grade A, B, or C) depending on the quality of evidence.[1]

MECHANICAL HEMOSTASIS DEVICES

Endoscopic clips

History. Initially used in the neurosurgical field, clips were first applied in the GI tract through a rigid endoscope to mark a gastric lesion 4 decades ago.[2] Since then, flexible devices were developed that are inserted through the instrument channel in flexible endoscopes. Further developments in clip technology, such as the ability to rotate (HX-5LR-1 Hemoclip MD 850, Olympus, America, Allentown, Pa), to reopen and close multiple times before deployment (Resolution clip, Microvasive Endoscopy, Boston Scientific, Natick, Mass; InScope, Ethicon Endosurgical, Cincinnati, Ohio), to flush water through the clip device (TriClip, Wilson-Cook Medical, Winston-Salem, NC), or to deploy 4 clips in one application session (InScope MultiClip Applier, InScope) have made the devices simpler and more user friendly.

Technology. Five endoscopic clips are available, each with distinctive features: (1) the Rotating clip, (2) the QuickClip2, (3) the TriClip, (4) the Resolution clip, and (5) InScope MultiClip Applier. Most of the literature on endoscopic hemostasis published so far is based on the experience with clips manufactured by Olympus.[3]

Technique. Familiarity with the devices, application, and limitations of the clips are critical for the appropriate choice of devices and successful endoscopic mechanical hemostasis of GI bleeding. The proper application of endoscopic clips involves a general multistep process, as shown in Videos 1 to 5 (available online at www.giejournal.org) and Figures 1 and 2. Practical tips to optimize the endoscopic clip application technique are outlined in Table 1.

Detachable snare (endoloop)

History. In the mid-1980s, Pontecorvo and Pesce[4] developed the first detachable snare, the ''safety snare.'' Hachisu[5] developed the first commercially available detachable snare for endoscopic use.

Technology. Two forms of detachable nylon loop snares (Olympus Medical, Tokyo, Japan) are available: (1) Endo-Loop is a reusable device with a 30-, 20- (in the United States), and 11-mm (in Japan) opening diameter and (2) Poly-Loop is a preassembled ready-to-use version of the Endo-Loop with a 30-mm opening diameter. In addition, a smaller Endo-Loop (11 mm) can be used for variceal ligation in conjunction with a transparent ligation chamber (Olympus MH-593) attached to the end of an endoscope.

The loop device has an outer plastic sheath and an inner metal coil around a central cable with a hook that houses the nylon loop. The elliptically shaped nylon loop has a silicone rubber stopper that permits customized tightening.

Technique. Detachable snares are predominantly used in the prevention of immediate and delayed polypectomy bleeding. Several practical tips to optimize the use of detachable snares are outlined in Table 2.

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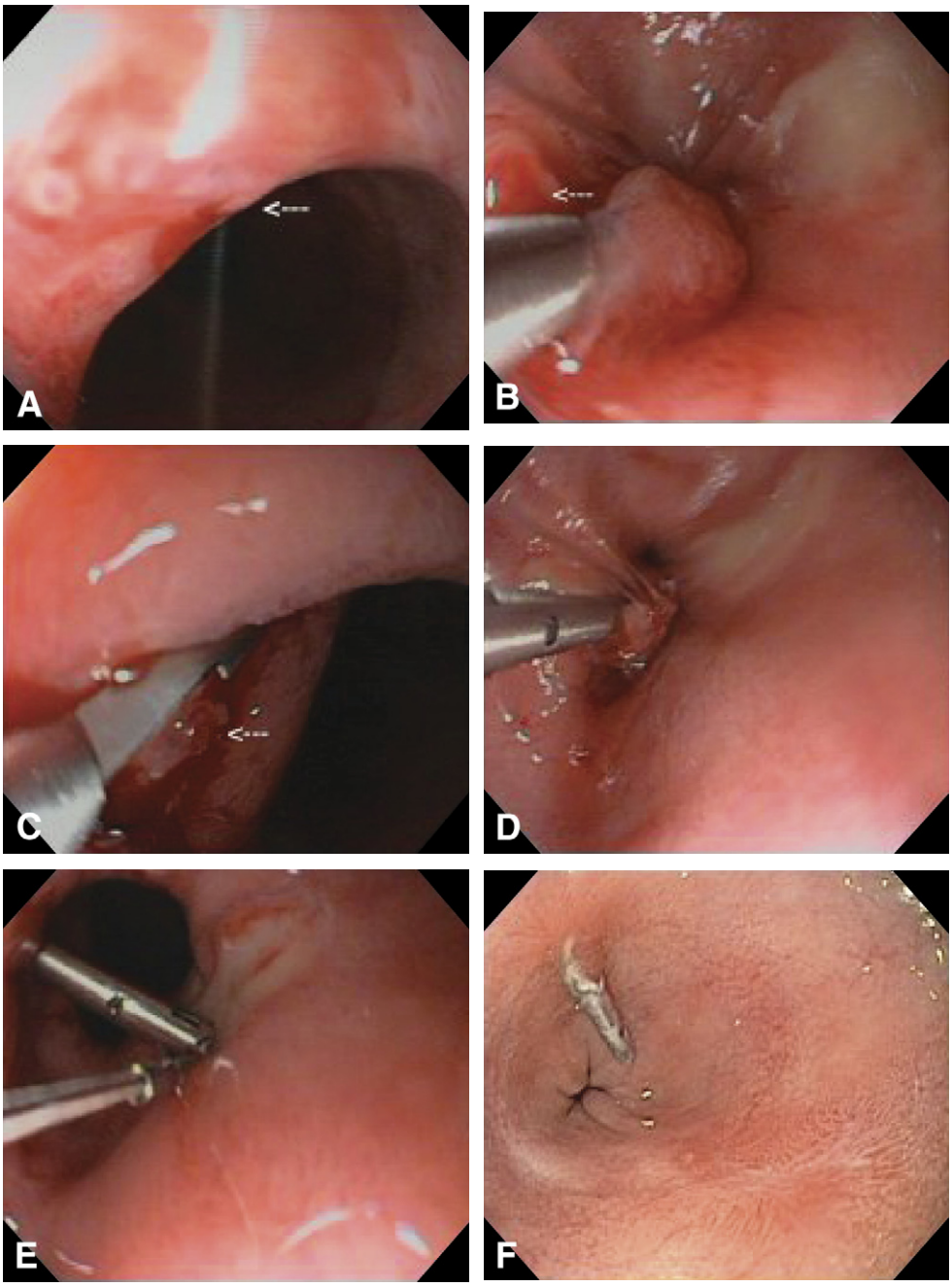

Figure 1. Endoscopic clip application of actively bleeding esophageal ulcer: the principles of using of an endoscopic clip to treat an actively bleeding visible vessel. In this example, an actively bleeding artery was localized within an esophageal ulcer. **A**, Clipping requires precision. A water-jet equipped therapeutic endoscope is important to maintain visualization of the target site. In addition, the head of the bed was elevated to improve visualization. The arterial bleeding vessel had been localized (*arrow*). **B**, The location of the bleeding site, posterior to the heart, posed a challenge due to the continuous movement from rapid heart beat. Thus, it was important to optimize clip handling by bringing it close to the tip of the endoscope. Before deployment, care was taken to ensure that the vessel was captured. The position of the clip, however, was too distal. Thus, as can be expected, the closed clip did not include the entire bleeding vessel and the surrounding tissue to the vessel. Bleeding did not stop. **C**, The clip was reopened and repositioned to be slightly more proximal to the bleeding vessel. Placing it slightly proximal to the vessel and pushing it leftward toward the wall (while the lumen was suctioned) allowed capture of as much underlying tissue to the vessel as possible, thus ensuring its efficacy. **D** and **E**, The clip was closed and slowly released. There was no further bleeding. The patient was prescribed oral proton-pump inhibitor medication twice daily. **F**, Two months later the ulcer healed. The clip remained in place.

Endoscopic band ligation

History. Van Stiegmann et al[6] developed the band ligation technology for esophageal varices management. With subsequent developments, the transparent endoscopic elastic band ligating device,[7] pneumatic release of bands,[8] and multiple band application in one session,[9]