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Mechanical Modalities of Endoscopic Therapy: Clips, Loops, and Beyond

Livio Cipolletta, MD, Gianluca Rotondano, MD, Maria Antonia Bianco, MD, and Roberto Piscopo, MD

Mechanical methods of endoscopic hemostasis are rapidly gaining acceptance due to their efficacy and safety. Nonetheless, some problems still exist as to their general applicability since both clipping and banding are technically demanding procedures which depend on the operator's expertise and team trained approach. Improvements in clip design and materials, together with progress in the loading and release systems will hopefully lead to the more widespread use of such mechanical methods with the aim of preventing recurrent bleeding. Elastic band ligation is a relatively simple procedure whose application in the management of nonvariceal bleeding has recently expanded to include selected patients with peptic ulcer bleeding.
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Upper nonvariceal gastrointestinal bleeding (NVB) is one of the most common medical emergencies and remains a major cause of morbidity and mortality among patients. Although initially employed diagnostically, endoscopy has steadily replaced surgery as a first-line treatment in all but the hemodynamically unstable patient. A vast selection of techniques and devices are now available to the dedicated therapeutic endoscopist, including injection therapy, contact and noncontact thermal coagulation, and mechanical banding or clipping. However, despite proven efficacy of different endoscopic interventions at achieving hemostasis, recurrent bleeding still occurs in about 15% to 20% of patients and represents the single most important predictor of adverse outcome. There is consolidated evidence that endoscopic therapy significantly decreases recurrent bleeding and mortality in high-risk patients with peptic ulcer hemorrhage.[1-3]

Endoscopic Clipping

When faced with severe NVB, the goal of the endoscopist is to rapidly achieve hemostasis in a simple, permanent, and safe manner. Endoscopic clipping theoretically may be the ideal method in case of visible vessel. Hemostasis may be definitive when the vessel is properly clamped, and the targeted application of the clip without any thermal or chemical effect nearly eliminates the risk of tissue injury. In experimental studies comparing mechanical, injection, and thermal methods of hemostasis, only mechanical methods (banding and clips) were effective on vessels greater than 2 mm in diameter.[4,5] Such apparently ideal conjunction between safety and efficacy has its own limited applicability, mainly due to the site and size of the bleeding lesion. Despite the fact that the hemoclip is a very simple device in itself, successful application of clips is highly dependent on operator expertise. The technically demanding nature of the procedure lies in the limited degree of freedom in the endoscopic movement and approach.

This may account for the controversial results quoted in the literature on the effectiveness of hemoclips. A large number of clinical studies performed in patients with severe peptic ulcer bleeding has demonstrated the efficacy of mechani-

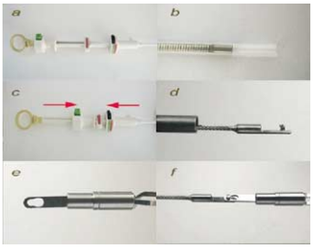

Figure 1 Loading the Olympus clip applicator. (a) The handle with the release button, rotator, slider, ratchet release button, and the thumb ring. (b) The distal portion of the applicator with the cable inside the Teflon tube sheath. (c) The slider is pushed toward the release button to load the applicator. (d) This extends the cable with its distal hook and pin out of the tube sheath. (e) The clip pipe and the clip connector (joint plate). (f) The clip connector is attached onto the hook of the operation wire.

Division of Gastroenterology and Digestive Endoscopy, Hospital Maresca, Torre del Greco.
Address reprint requests to Livio Cipolletta, MD, Via S. Domenico 24, 80126 Naples, Italy. E-mail: cipollet@tin.it

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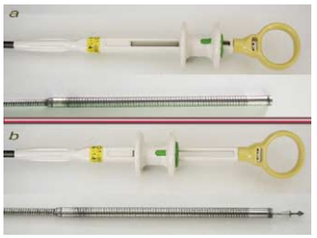

Figure 2 The Olympus EZ clip (prototype). (a) When the slider is pulled proximally toward the ring, the distal coil sheath is in release position. (b) When the slider is pushed distally, the connector is extended from the coil sheath.

cal methods of hemostasis, with hemostasis rates well over 90%.[6-23] Nonetheless, available data do not support the superiority of this approach over other endoscopic methods of hemostasis. The lack of conclusive evidence is not due to the impossibility to demonstrate safety and efficacy, but rather to the aforementioned limited applicability. Such a selection *bias* does not allow a comparison at an equal level with other methods which are easier to perform and applicable to a wider range of anatomical and clinical situations. Continuous improvement in materials and technology of both clips and release systems will likely lead to a more widespread use of mechanical methods in the near future, especially if the type of lesions more suitable for such treatment is precisely identified.

Systems for Hemoclipping

Olympus

The Olympus system consists of stainless steel clips with prongs which measure 6 mm in length and 10 mm in width and a rotatable clip fixing device. Two types of clips are available: the right-angle clip and the obtuse-angle clip (130°), recommended for less elastic tissue such as chronic ulcers and tumors. The applicator device consists of a stainless steel cable with a handle and a covering Teflon sheath. The handle consists of two sliding components that are used to manipulate the clip (Fig. 1). To load the applicator, the clip is connected by a joint plate to a hook at the tip of the cable and is inserted into the sheath. The clip is projected from the sheath by pushing the back sliding component toward the front one. On pulling the back-slider, the prongs are fully opened and the clip can be applied to the bleeding point (Fig. 1). Often the orientation of the clip does not meet the demands of the situation. The orientation of the opened clip can be somewhat adjusted by rotating the applicator handle. If the effect is still inadequate, the entire handle can be turned clockwise until the clip is brought into the desired orientation. Additionally, optimal orientation of the clip also may be achieved by moving the tip of the endoscope while anchoring one prong on the healthy mucosa, using it as a fulcrum. When the clip is properly oriented, the prongs are kept in contact with gentle pressure against the lesion and the back-slider is pulled to close the clip tightly and detach it from the cable. When applied, the prongs should either grasp the vessel or approximate the healthy margins of the ulcer. Because the clip connector may easily fall off the hook of the operation wire after detachment of the clip and may occlude the suction valve if accidentally aspirated, the tube sheath is pushed over the clip connector before withdrawal of the applicator. Since multiple clips may be required, two clip applicators and a second assistant to reload the device should be available.

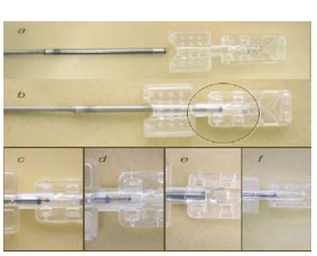

Figure 3 The Olympus EZ clip (loading of the clip). (a) To attach the clip, pull the slider up to the ring and place the cartridge on the coil sheath; (b) hold the coil sheath in position by pinching the grip of the cartridge; (c–f) keep pinching the grip of the cartridge until the clip has been attached completely.

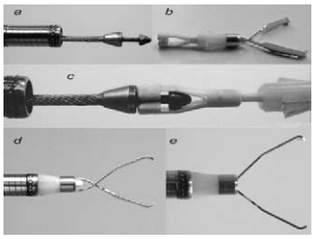

Figure 4 The Olympus EZ clip (application of the clip). (a) Enlarged view of the hook extending from the coil sheath when the slider is pushed forward. (b) The clip as it comes out of the cartridge with its plastic white connector. (c) Detailed view of the clip connection onto the operating wire. (d) As for the standard applicator, the clip is firmly held on the coil sheath and projected out at the target site. (e) Maximal spreading of the prongs is achieved by pulling the slider slowly toward the yellow ring.

Olympus has also marketed a single-use preloaded rotatable clip device (QuickClip 2™). Once removed from the package, the device can be inserted down the endoscope channel and extended from the distal end of the scope, and the red stopper on the handle should be removed. At this point, the yellow cylinder should be pulled toward the handle to extend and open the clip to its maximum width by slowly pulling the slider a short distance toward the thumb ring. Rotate the clip to align it with the targeted site, turning the handle while holding the yellow cylinder until the clip is

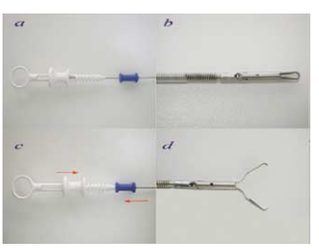

Figure 5 The Resolution clip by Boston Scientific. (a) The handle in release position and the blue over-sheath grip. (b) The clip is closed and ready to be inserted in the channel of the endoscope. (c) To open the clip, maneuver the handle pushing the slider distally and pulling the blue over-sheath grip proximally. (D) The Resolution clip is fully exposed and wide open, ready to grasp tissue.