

# Comparison of hemostasis using bipolar hemostatic forceps with hemostasis by endoscopic hemocclipping for nonvariceal upper gastrointestinal bleeding in a prospective non-randomized trial

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## Abstract

**Background** We previously reported on the safety and efficacy of bipolar hemostatic forceps for treating non-variceal upper gastrointestinal (UGI) bleeding. However, no prospective or randomized studies have evaluated the efficacy of bipolar hemostatic forceps. The aim of this study was to evaluate the hemostatic efficacy of using bipolar hemostatic forceps compared with the hemostatic efficacy of the commonly used method of endoscopic hemocclipping for treating nonvariceal UGI bleeding.

**Methods** A total of 50 patients who required endoscopic hemostasis for UGI bleeding were divided into two groups: those who underwent endoscopic hemostasis using bipolar hemostatic forceps (Group I) and those who underwent endoscopic hemostasis by endoscopic hemocclipping (Group II). We compared the two groups in terms of hemostasis success rate and time required to achieve hemostasis and stop recurrent bleeding.

**Results** All (100 %) of 27 patients in Group I and 18 (78.2 %) of 23 patients in Group II were successfully treated using bipolar hemostatic forceps or by endoscopic hemocclipping alone, respectively, indicating a significantly higher success rate for Group I than for Group II ( $p < 0.05$ ). The time required to achieve hemostasis was  $6.8 \pm 13.4$  min for Group I and  $15.4 \pm 17.0$  min for Group II. One patient in Group I (3.7 %) and four patients in Group II (22.2 %) experienced recurrent bleeding.

**Conclusion** Bipolar hemostatic forceps was more effective than endoscopic hemocclipping for treating nonvariceal UGI bleeding.

**Keywords** Bipolar forceps · Gastrointestinal ulcers · Endoscopy · Hemostasis

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Upper gastrointestinal (UGI) bleeding is often encountered in clinical practice. The severity of this condition ranges from mild to severe and requires rapid diagnosis and treatment. Endoscopic hemocclipping was commonly used for treating nonvariceal UGI bleeding. Endoscopic submucosal dissection (ESD) for early gastric carcinoma has been widely performed in many hospitals [1]. The use of hemostatic forceps with soft coagulation in the management of gastric bleeding during ESD has been reported [2]. Recently, hemostatic forceps has been used for emergency endoscopic hemostasis in cases of nonvariceal UGI bleeding [3–5]. In contrast, we have been using bipolar hemostatic forceps (HemoStat-Y, Pentax, Tokyo, Japan) to stop intraoperative bleeding during ESD since September 2006 for emergency endoscopic hemostasis in the management of nonvariceal UGI bleeding. We previously reported the usefulness and safety of bipolar hemostatic forceps for nonvariceal UGI bleeding [6]. However, to the best of our knowledge, there

have been no reports comparing the effectiveness of bipolar hemostatic forceps and hemoclippping for hemostasis in nonvariceal UGI bleeding.

The aim of this prospective nonrandomized study was to evaluate the hemostatic efficacy of bipolar hemostatic forceps compared with that of the commonly used endoscopic hemoclippping for treating non variceal UGI bleeding.

## Subjects and methods

Of the 110 patients with UGI bleeding who presented with melena or hematochezia and underwent emergency endoscopy between September 2008 and December 2009, we examined 50 patients (37 men and 13 women) who required endoscopic hemostasis for nonvariceal UGI bleeding or nonbleeding visible vessels at our institution. Written informed consent was obtained from all patients before endoscopic examination. The 50 patients were divided into two groups: those who were assigned to endoscopic hemostasis using bipolar hemostatic forceps (Group I; subjects were given even numbers) or those who were assigned to endoscopic hemostasis by endoscopic hemoclippping (Group II; subjects were given odd numbers). We compared the two groups in terms of hemostasis success rate at the initial attempt and time required to achieve hemostasis (measured from the start of the bipolar hemostasis procedure or endoscopic hemoclippping until achievement of hemostasis). Additionally, we evaluated recurrent bleeding. Rebleeding was defined as the occurrence of new hematemesis or melena, comorbid with either shock or a decrease in the patient's hemoglobin concentration of greater than 2 g/dl during a 24 h period after the initial stabilization of pulse, blood pressure, and hemoglobin concentration. When

rebleeding was suspected, endoscopic hemostasis was immediately performed. We used a Q260 J endoscope with a water-jet system (Olympus Medical Systems, Tokyo, Japan). The procedure in Group I patients was performed with a bipolar mode setting of 30 W in the attached electrosurgical unit (ICC 200; ERBE Elektromedizin, Tübingen, Germany). For patients in Group II, hemoclips (HX-610-135 and HX-610-135S; Olympus Optical Co. Ltd., Tokyo, Japan) were placed on the ulcer base to bind the visible bleeding or nonbleeding vessels. Written informed consent was obtained from all subjects before the procedure. This study was approved by the Institutional Review Board (IRB) of our institution. It was explained to the patients that treatment in a prospective IRB study was covered by Japanese national insurance and they gave consent.

Statistical analysis was performed using Fisher's exact test. A *p* value of less than 0.05 was considered to represent a statistically significant difference.

## Results

Table 1 gives the characteristics of the patients in both groups. There were no significant differences between the two groups with respect to age, sex ratio, or causal diseases. The bleeding state according to the Forrest classification did not differ between the two groups. The average years of experience of the endoscopists who performed the emergency procedures did not statistically significantly differ between the two groups.

Table 2 gives the results of endoscopic hemostasis in both groups. Initial hemostasis using bipolar hemostatic forceps alone was successful in 27 (100 %) of the 27 patients in Group I. Initial hemostasis by endoscopic hemoclippping alone was successful in 18 (78.2 %) of the

**Table 1** Patient characteristics of the two groups

	Group I ( <i>n</i> = 27)				Group II ( <i>n</i> = 23)			
Mean age (range) (years)	65.5 ± 13 (29–83)				69.0 ± 9.0 (49–84)			
Sex ratio	21:6				16:7			
Causal diseases	Forrest classification				Forrest classification			
	Ia	Ib	IIa	Total	Ia	Ib	IIa	Total
Gastric ulcer	3	3	10	16	4	2	7	13
Duodenal ulcer	2	3	5	10	2	3	2	7
Mallory-Weiss syndrome	0	0	0	0	0	1	1	2
Gastric cancer	0	1	1	1	0	0	0	0
Esophageal ulcer	0	0	0	0	0	1	0	1

Values are presented as means ± standard deviation (SD)

Group I patients treated using bipolar hemostatic forceps; Group II patients treated by endoscopic hemoclippping

**Table 2** Hemostasis ratio, recurrent bleeding ratio, and time required to achieve hemostasis

	Group I ( <i>n</i> = 27)	Group II ( <i>n</i> = 23)
Initial hemostasis with single modality success rate	100 % (27/27)*	78.2 % (18/23)
Recurrent bleeding	3.7 % (1/27)	22.2 % (4/18)
Required time for hemostasis (range) (min)	6.8 ± 13.4 (0.5–30)	15.4 ± 17.0 (0.5–60)

Values are presented as means ± SD

Group I patients treated using bipolar hemostatic forceps; Group II patients treated by endoscopic hemoclipping

\*  $p < 0.05$  compared with Group II

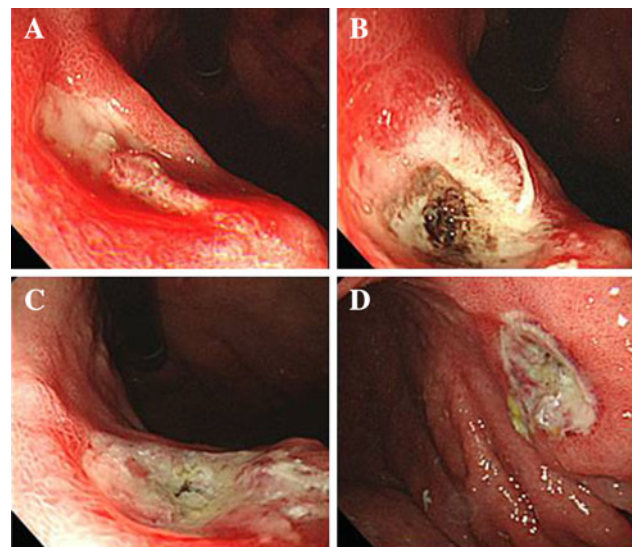
23 patients in Group II. The initial hemostasis rate using a single modality was significantly higher in Group I than in Group II (100 vs. 78.2 %;  $p < 0.05$ ). The endoscopic hemostasis rate for the initial modality in combination with another endoscopic procedure performed after the initial method was 100 % in Group II. Among the patients who rebled, three had gastric ulcers and two had duodenal ulcers. There was one duodenal ulcer (IIa) in Group I and two gastric ulcers (IIa, IIa) and two duodenal ulcers (Ia, IIa) in Group II. The rebleeding rate was 3.7 % (1/27) for Group I and 22.2 % (4/18) for Group II, but the difference was not statistically significant. All of the patients with rebleeding were successfully treated with additional procedures for endoscopic hemostasis, and neither surgery nor interventional radiology was required for achieving final hemostasis. The time required to achieve hemostasis was shorter in Group I than in Group II (6.8 ± 13.4 vs. 15.4 ± 17.0 min), but the difference was not statistically significantly different.

## Discussion

Peptic ulcers such as gastroduodenal ulcers are major causes of UGI bleeding. Endoscopic hemostasis has come to play a central role in the initial treatment for this condition [7]. At present, commonly used methods of endoscopic hemostasis include a local ethanol injection, clipping, and argon-plasma coagulation. In particular, hemostasis by endoscopic hemoclipping has been widely used and its usefulness has been reported [8–10]. Recently, hemostasis with soft coagulation using endoscopic hemostatic forceps was introduced mainly to manage bleeding during ESD [11]. Presently, this method is widely utilized to manage cases of bleeding gastric ulcers in Japan.

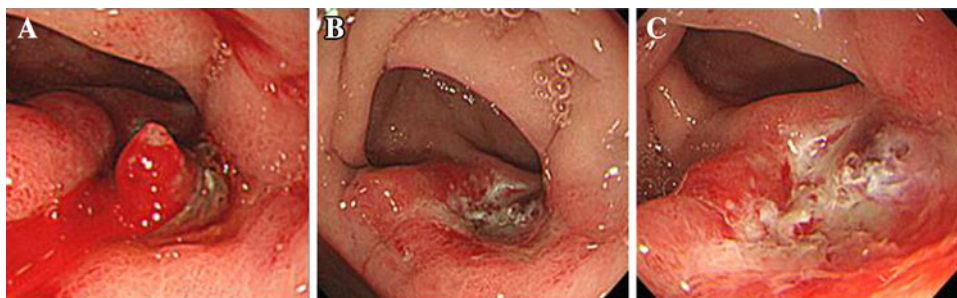
We have been using bipolar forceps for hemostasis to manage bleeding during ESD since 2006. We use bipolar forceps for emergency endoscopic hemostasis in the management of nonvariceal UGI bleeding. Radiofrequency coagulation (a type of thermal coagulation) can be classified into either monopolar or bipolar modalities. For the forceps used in the bipolar technique, the electric current

flows between the cups at the tip only, minimizing the potential for thermal injury to the surrounding tissue and enabling effective coagulation and hemostasis. Bipolar forceps for hemostasis are reported to allow reliable identification of the bleeding point and thus manifest satisfactory hemostatic effects [12]. We previously reported on the safety and efficacy of bipolar hemostatic forceps and have established a simple technique of hemostasis by which the forceps are kept open and compress the bleeding area to effect coagulation and hemostasis [6]. This is a simple device that does not require a counter electrode. Because of these features, the bipolar technique is considered to be safer than the monopolar technique. However, to the best of our knowledge, no prospective or randomized studies have evaluated the efficacy of bipolar hemostatic forceps for hemostasis in nonvariceal UGI bleeding. In the present prospective nonrandomized study, we evaluated whether the use of bipolar hemostatic forceps was as effective as endoscopic hemoclipping for treating nonvariceal UGI bleeding. The results of this study indicate that the initial



**Fig. 1** A 62-year-old man with hemorrhagic gastric ulcer. **A** The exposed blood vessel of the ulcer on the posterior wall of the upper gastric body. **B** Immediately after hemostasis using bipolar hemostatic forceps. **C, D** The day after hemostasis

**Fig. 2** A 72-year-old man with a hemorrhagic gastrojejunal anastomosis ulcer in the postoperative stomach. **A** A blood clot was observed adhering to the ulcer and hemorrhage was confirmed. **B**, **C** Immediately after hemostasis using bipolar hemostatic forceps



hemostasis success rate with a single modality was significantly higher using bipolar hemostatic forceps than by endoscopic hemoclippping (100 vs. 78.2 %;  $p < 0.05$ ). Furthermore, the rate of rebleeding was lower, and the time required to achieve hemostasis was shorter using bipolar hemostatic forceps than by endoscopic hemoclippping for treating UGI bleeding.

Bipolar hemostatic forceps has some additional advantages. In terms of safety, in cases where the bleeding site or the exposed blood vessels are located along a tangential direction, or in cases where the ulcer floor was too firm to grasp by forceps, the forceps was maintained in an open position and the ulcer floor was compressed to achieve coagulation and hemostasis. In contrast, endoscopic hemoclippping cannot be used on the hard base of an ulcer and it is difficult to use in a tangential direction. However, there are some desirable refinements for future models. Bipolar hemostatic forceps is large and the range of movement upon opening and closing is limited. If these features are improved, bipolar hemostatic forceps may become very useful for endoscopic hemostasis (Figs. 1, 2).

In conclusion, this study demonstrated that endoscopic hemostasis using bipolar hemostatic forceps was more effective than endoscopic hemoclippping for treating non-variceal UGI bleeding. In addition, the success rate of initial hemostasis by a single modality was significantly higher using bipolar hemostatic forceps than by endoscopic hemoclippping. Furthermore, the rate of rebleeding was lower and the time required to achieve hemostasis was shorter using bipolar hemostatic forceps than by endoscopic hemoclippping. These findings suggest that bipolar hemostatic forceps should be routinely considered for treating nonvariceal UGI bleeding.

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