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## Case Series

# Hemospray<sup>®</sup> during Emergency Endoscopy: Indonesia's First Experience from 37 Patients

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## Keywords

Hemospray<sup>®</sup> · Hemostatic powder · Gastrointestinal bleeding · Emergency endoscopy

## Abstract

Gastrointestinal bleeding (GIB) is one of the main indications for performing endoscopy; this condition can be life threatening. In some cases, emergency endoscopy (EE) is necessary to identify the source and stop the bleeding. Recently, hemostatic powder was introduced, one of which was Hemospray<sup>®</sup> (Cook Medical, Winston-Salem, NC, USA), which showed promising results for rapid hemostasis in primary treatment and salvage when conventional methods fails. Samples were taken retrospectively for a duration of 3 years since Hemospray was first introduced in Indonesia, from January 2016 to January 2019. The total number of EEs that used Hemospray were 37 procedures for 37 patients; 21 (56.8%) were males and 16 (43.2%) were females, while the average age was 67.8 years. Hemospray was used for upper GIB in 30 cases (81.1%) and for lower GIB in 7 (18.9%). Hemospray was used as monotherapy for 24 patients (64.9%) and as secondary modality for 13 (35.1%). The primary treatment was argon plasma coagulation in 8 cases (21.6%), adrenaline in 4 (10.8%), and Histoacryl<sup>®</sup> in 1 (2.7%). The mor-

tality rate was 37.8% ( $n = 14$ ); most deaths occurred within 30 days after the EE was performed, and none of the deaths was related to endoscopy or GIB. Hemospray was able to achieve hemostasis in all cases. Furthermore, there was no event of rebleeding. When conventional modalities alone were inadequate, the combination with Hemospray appeared to be able to control the bleeding. One of the main advantages of Hemospray is the ease in reaching difficult areas, and it requires less skill compared to conventional modalities.

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## Introduction

Gastrointestinal bleeding (GIB) affects approximately 150 patients per 100,000 population each year [1, 2]. Upper gastrointestinal bleeding (UGIB) alone resulted in 300,000 hospitalizations annually in the USA with a mortality rate of 3.5–10%. The most common cause of bleeding is peptic ulcer, while variceal bleeding is another major contributor for UGIB and has a high mortality rate in cirrhotic patients – approximately 20%. Other causes of bleeding include Mallory-Weiss syndrome and malignancy [3–6]. On the other hand, the annual incidence of lower gastrointestinal bleeding (LGIB) is estimated to be 0.03%, and around 20–30% of cases with major GI bleeding originated from LGIB [7].

Endoscopic intervention has been the treatment of choice for the assessment and treatment of GIB. Depending on the location and type of bleeding, different hemostasis techniques have been developed, such as: injection, hemoclips, thermocoagulation, cyanoacrylate, etc. However, despite the numerous techniques, in approximately 10–30% of cases hemostasis cannot be achieved and 5–10% have bleeding recurrence [8, 9].

Recently, hemostatic spray powder has been developed. It consists of inorganic powder that acts as cohesive and adhesive when it is in contact with moisture on the mucosa to make a mechanical barrier and seal the bleeding [10]. The powder is neither absorbed nor metabolized, therefore reducing the risk of toxicity [9]. Previous studies have shown that Hemospray® is able to obtain rapid hemostasis as primary treatment or as secondary treatment when conventional methods are inadequate, in which the success rate is reported to be as high as 100% [11–13]. This study aims to report the rebleeding rate in 24 hours and 30 days while using Hemospray powder for emergency endoscopy (EE) as primary and secondary modality.

## Methods

The records were gathered retrospectively. We included all patients in a single large-volume endoscopy center from a tertiary hospital who presented with GIB. EE was performed with the use of Hemospray, either for primary or secondary treatment. The samples were collected in years, from the first time Hemospray was available in our center since January 2016 until January 2019. EE was performed when the patient presented with acute massive GIB (e.g., hematemesis, melena and/or hematochezia) with hemorrhagic shock (e.g. tachycardia, hypotension), and with a Glasgow-Blatchford score (GBS) >7. The EE was performed within

12 hours of presentation (urgent or very early endoscopy). Colonoscopy or esophagoduodenoscopy is selected from the suspected bleeding site based on clinical presentation.

The hemostatic powder was applied using the standard 10-Fr catheter provided by the manufacturer (Cook Medical, Bloomington, IN, USA) into the working channel of the endoscope at a distance of approximately 2–3 cm from the bleeding site, sprayed in several bursts of powder. Figure 1a and b shows an example of the Hemospray application on a peptic ulcer Forrest 1b. Hemospray was used as monotherapy or as secondary therapy after conventional therapy (adrenaline injection (1:10,000), argon plasma coagulation, or Histoacryl® for variceal bleeding) at the decision of the endoscopist.

The endpoint of this study is to assess the short-term outcome measured by endoscopic observation of bleeding cessation and the long-term outcome which is rebleeding rates within 30 days with the sign of hematemesis, melena, and/or hematochezia.

## Results

### *Patient Characteristics*

During the course of this 3-year study, we registered a total number of 2,990 endoscopies for both upper and lower GIB; among those, 37 were very early EE performed within 12 hours of patient presentation. Patient age ranged from 30 to 92 years (mean age 67.8 years); 21 (56.8%) were males and 16 (43.2%) were females. The number of patients with UGIB and LGIB symptoms were 30 (81.1%) and 7 (18.9%), respectively (Table 1). The average GBS was 13.3 (range 8–18).

### *Hemostatic Intervention*

Hemospray was administered as monotherapy in 24 patients (64.9%) and as secondary to conventional therapy in 13 patients (35.1%). Hemospray as monotherapy was administered for UGIB from ulcers in 9 patients (24.3%), cancer-related bleeding in 7 (18.9%), and fundal varices bleed in 2 (5.4%). As for LGIB, Hemospray was used for ulcers in 3 patients (8.1%), cancer-related bleeding in 1 (2.7%), and inflammatory bowel disease in 2 (5.1%) (Table 2).

When conventional therapy failed to achieve hemostasis, Hemospray was applied as secondary treatment. Secondary treatment was given for patients with UGIB from ulcers who were given adrenaline with no effect in 4 cases (10.8%), unsuccessful hemostasis after argon plasma coagulation which originated from ulcer in 4 (10.8%), cancer-related bleeding in 1 (2.7%), portal hypertensive gastropathy in 2 (5.4%), and LGIB bleeding from colon ulcer in 1 (2.7%). For fundal variceal bleeding hemostatic powder was used as secondary treatment after Histoacryl in 1 patient (2.7%).

### *Hemostatic Outcome*

Hemospray was successful in attaining hemostasis in all cases (37/37, 100%) for short-term hemostasis, which we defined as endoscopic observation of bleeding cessation. There was no episode of rebleeding for the follow-up duration of 30 days. Thus, the application of Hemospray also resulted in 100% long-term success. No adverse reaction was reported after the administration of Hemospray (Table 3).

### Mortality

Of the 37 patients, the mortality rate was 37.8% ( $n = 14$ ), with an average GBS upon admission of 16.2 (range 14–18). The increase of GBS was due to other causes such as hepatic disease and heart failure, and more severe hemodynamic instability. The cause of death in all of the patients was not related to GIB or endoscopy, and none of the patients died within 24 hours of endoscopy intervention (Table 3). In 1 patient, cardiac arrest occurred within 72 hours after endoscopy. Four patients died within 7 days of endoscopy, 2 of which were caused by respiratory failure, 1 by cardiac arrest, and 1 by pancreatic carcinoma. Mortality from day 7 up to day 30 after endoscopy was 6 patients, caused by cardiac arrest, respiratory failure, multi-organ failure, and septic shock. The remaining 3 mortalities occurred after 30 days of endoscopic treatment.

### Discussion

From our first experience of using Hemospray in Indonesia, we discovered that Hemospray, applied as monotherapy or secondary to conventional therapy, was an efficient tool for controlling GIB with a success rate of 100% for short- and long-term outcomes. When it was used as monotherapy, our finding on the short-term bleeding success rate was similar to previous studies, which also showed promising results, as performed by Hagel et al. [14] (97%), Yau et al. [12] (93.3%), Sung et al. [15] (95%), and Hookey et al. [16] (98%). Our finding on the short-term result from conventional therapy combined with Hemospray was also consistent with previous studies with a success rate of 100% [11, 17].

The timing of endoscopy is crucial. Therefore, we decided to perform EE within 12 hours for high-risk patients with GBS >7. Several studies have shown that early endoscopy might benefit high-risk patients, especially in reducing the mortality rate. Cho et al. [18] showed that urgent endoscopy (<6 h) for high-risk patients (GBS >7) with acute non-variceal UGIB was an independent predictor of lower mortality rate. Another study by Lim et al. [19] showed that endoscopy performed within 13 hours of presentation was associated with lower mortality in high-risk patients (GBS ≥12). Therefore, the evidence suggests that earlier endoscopy within 12 hours may result in better outcome.

There were no cases of rebleeding during the observation period of 30 days. This data was consistent with previously published data on the use of Hemospray for LGIB, with 30-day recurrent bleeding rate of 0% [20–22]. Other sources reported that the overall rebleeding rate after Hemospray for UGIB was estimated around 11–31% [12]. The higher rates of rebleeding may be attributed to salvage therapy use. Thus, there are frequent encounters with thrombocytopenia, coagulopathy, antiplatelet use, anticoagulant use, patients with deep ulceration that erode the artery, and malignancy [12, 14].

We managed 3 variceal cases: 2 patients with esophageal varices and 1 patient with fundal variceal bleeding. For the 2 patients with esophageal varices, Hemospray was applied as monotherapy for bleeding stabilization, whereas for the patient with fundal variceal bleeding, Hemospray was used after the application of Histoacryl. All 3 patients successfully achieved hemostasis shortly afterwards and there was no incidence of rebleeding within 30 days. A randomized controlled trial by Ibrahim et al. [23] stated that early application of hemostatic powder improved hemostasis in patients with a first episode of acute variceal

bleeding from esophagogastric varices, in which they were able to stabilize esophagogastric varices bleeding and achieve clinical and endoscopic hemostasis using Hemospray in 38 patients. Hemostatic powder may provide early bleeding stabilization; therefore, definitive treatment can be performed under optimal, elective, or non-emergent conditions.

During the course of follow-up there were no Hemospray-related adverse events found. Although it was considered safe, previous publications have reported a few adverse outcomes after Hemospray use, such as gastric or variceal perforation and splenic infarct [12, 14]. Another possible adverse outcome was powder embolization, yet the risk was very low since the pressure of the carbon dioxide used to propel the powder was unlikely to overcome the blood pressure [15]. Giday et al. [24] found no evidence of powder embolization histologically in the systemic tissues including the spleen, even when the given dose was 7-fold greater than most clinical use.

It is noteworthy that when this study was conducted, we followed the algorithm for the approach to management of acute non-variceal bleeding and the use of hemostatic agents in a systematic review in 2013 [25] (Fig. 2). The most recent 2019 guideline recommendation from the international consensus of non-variceal UGIB does not recommend the use of hemostatic powder in actively bleeding ulcers as a monotherapy [26].

In conclusion, Hemospray shows a promising result in managing both upper and lower GIB. Our study showed that this novel modality can be used either as monotherapy or as salvage after the usual modality fails. However, based on the latest guideline, Hemospray is not recommended as a sole treatment. Nevertheless, the use of Hemospray allows the endoscopists to treat GIB originated from areas that are difficult to reach, due to its noncontact nature.

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### Statement of Ethics

This study received approval from Santo Borromeus Hospital Bandung ethics committee (ethical clearance No. 003/KERS/I/2019). Consent was obtained from the patients and/or their families for publication.

### Disclosure Statement

The authors have no conflicts of interest to declare.

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## Author Contributions

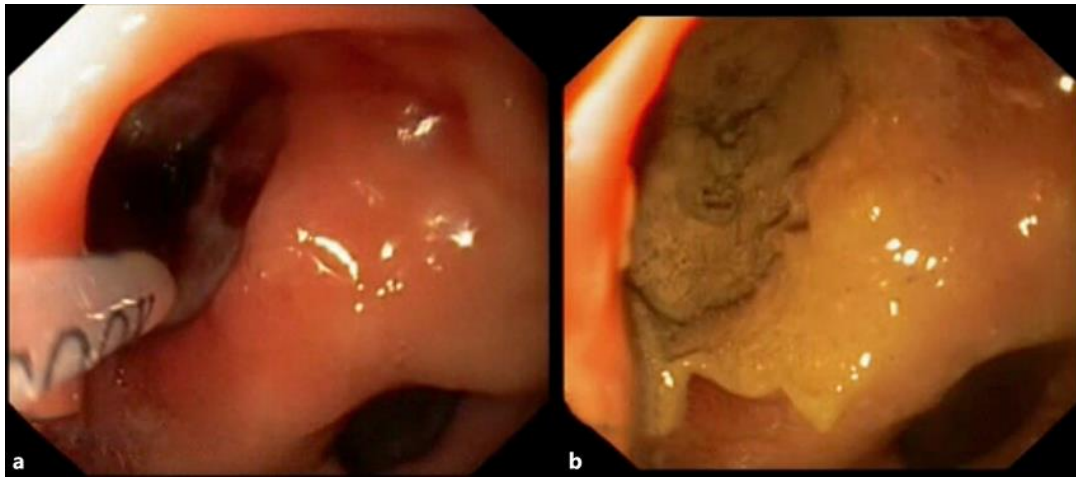
M.B.B., J.T.A., and D.G. performed the endoscopy procedures. S.A.A. managed the patients during hospitalization and followed up the patients. M.B.B. and I.R.J. collected the data and wrote and revised the manuscript.

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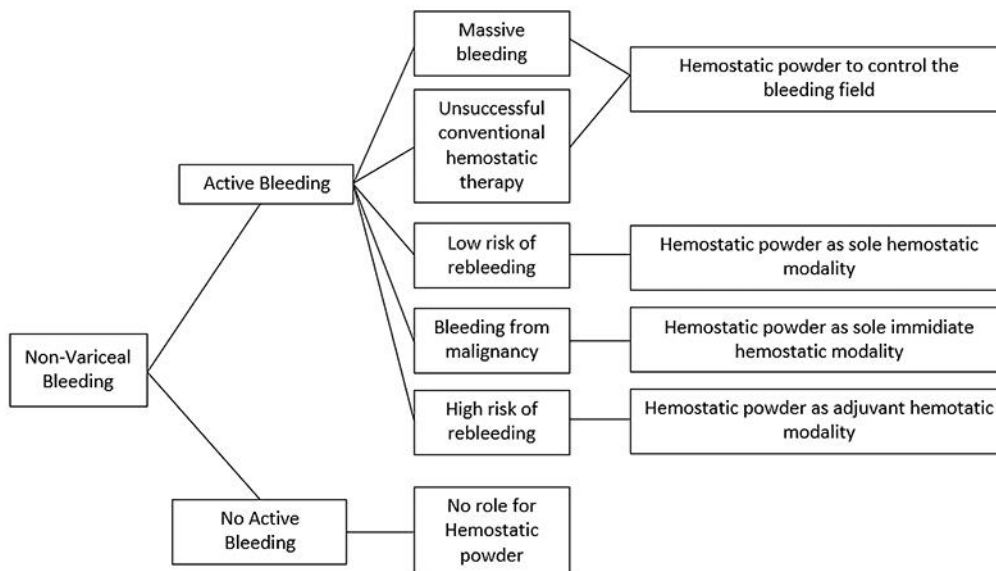
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This case has been presented as a poster during ACG 2019 in San Antonio, Texas, USA, and published as an abstract in the *American Journal of Gastroenterology* (2019 Oct;114(Suppl): S539). The full manuscript has not been submitted/published elsewhere. The current publication has been added as the most recent discussion regarding the use of Hemospray



**Fig. 1.** Esophagoduodenoscopy images. **a** Peptic ulcer bleeding (Forrest 1b). **b** Bleeding site after Hemospray application.



**Fig. 2.** Algorithm for approach to management of acute nonvariceal bleeding and the role of hemostatic agents.



**Table 1.** Patient characteristics and bleeding location based on symptoms

Age, years	67.8 (30–92)
Gender	
Male	21 (56.8)
Female	16 (43.2)
Suspected bleeding site	
UGIB	30 (81.1)
LGIB	7 (18.9)

Data are presented as mean (range) or *n* (%). UGIB, upper gastrointestinal bleeding; LGIB, lower gastrointestinal bleeding.

**Table 2.** Bleeding source and Hemospray application (as monotherapy vs. secondary therapy)

Modalities	UGIB				LGIB			Total
	ulcer	cancer	varices	PHG	ulcer	cancer	IBD	
Monotherapy	9 (24.3)	7 (18.9)	2 (5.4)	–	3 (8.1)	1 (2.7)	2 (5.4)	24 (64.9)
Secondary therapy	8 (21.6)	1 (2.7)	1 (2.7)	2 (5.4)	1 (2.7)	–	–	13 (35.1)
Adrenaline	4 (10.8)	–	–	–	–	–	–	4 (10.8)
APC	4 (10.8)	1 (2.7)	–	2 (5.4)	1 (2.7)	–	–	8 (21.6)
Histoacryl	–	–	1 (2.7)	–	–	–	–	1 (2.7)

Data are presented as *n* (%). UGIB, upper gastrointestinal bleeding; LGIB, lower gastrointestinal bleeding. PHG, portal hypertensive gastropathy; IBD, inflammatory bowel disease; APC, argon plasma coagulation.

**Table 3.** Hemostatic outcome and mortality

	Patients
Overall success	
Short-term <sup>a</sup>	37/37 (100)
Long-term <sup>b</sup>	26/26 (100)
Mortality causes	
GIB or endoscopy-related	–
Other	14/37 (37.8)
Mortality	
Within 24 h	–
Within 24–72 h	1/37 (2.7)
Within 3–7 days	4/37 (10.8)
Within 7–30 days	6/37 (16.2)
More than 30 days	3/37 (8.1)

Data are presented as *n* (%). <sup>a</sup> Endoscopic observation of bleeding cessation. <sup>b</sup> No rebleeding episode for 30 days.