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Hemospray® (hemostatic powder TC-325) as monotherapy for acute gastrointestinal bleeding: a multicenter prospective study

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Abstract

Background Hemostatic powders are used as second-line treatment in acute gastrointestinal (GI) bleeding (AGIB). Increasing evidence supports the use of TC-325 as monotherapy in specific scenarios. This prospective, multicenter study evaluated the performance of TC-325 as monotherapy for AGIB.

Methods Eighteen centers across Europe and USA contributed to a registry between 2016 and 2022. Adults with AGIB were eligible, unless TC-325 was part of combined hemostasis. The primary endpoint was immediate hemostasis. Secondary outcomes were rebleeding and mortality. Associations with risk factors were investigated (statistical significance at P≤0.05).

Results One hundred ninety patients were included (age 51-81 years, male: female 2:1), with peptic ulcer (n=48), upper GI malignancy (n=79), post-endoscopic treatment hemorrhage (n=37), and lower GI lesions (n=26). The primary outcome was recorded in 96.3% (95% confidence interval [CI]: 92.6-98.5) with rebleeding in 17.4% (95%CI 11.9-24.1); 9.9% (95%CI 5.8-15.6) died within 7 days, and 21.7% (95%CI 15.6-28.9) within 30 days. Regarding peptic ulcer, immediate hemostasis was achieved in 88% (95%CI 75-95), while 26% (95%CI 13-43) rebled. Higher ASA score was associated with mortality (OR 23.5, 95%CI 1.60-345; P=0.02). Immediate hemostasis was achieved in 100% of cases with malignancy and post-intervention bleeding, with rebleeding in 17% and 3.1%, respectively. Twenty-six patients received TC-325 for lower GI bleeding, and in all but one the primary outcome was achieved.

Conclusions TC-325 monotherapy is safe and effective, especially in malignancy or post-endoscopic intervention bleeding. In patients with peptic ulcer, it could be helpful when the primary treatment is unfeasible, as bridge to definite therapy.

Keywords Hemospray®, TC-325, endoscopy, upper gastrointestinal bleeding

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Conflict of Interest: Rehan J. Haidry declares: Pentax Medical, Apollo Endosurgery, Medtronic, Odin Vision, Cook Endoscopy, Fractyl Limited, Endogastric Solutions; Enrique Rodríguez de Santiago declares: Olympus, Norgine and Apollo Endosurgery (Educational activities) Adacyte therapeuthics (Advisory); Seth A. Gross declares: Cook, Medtronic, Olympus, Microtech. The other authors have nothing to declare

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Introduction

Acute gastrointestinal (GI) bleeding (AGIB) is a common medical emergency, especially in an era when antithrombotic agents are widely used [1,2]. Depending on the origin of the bleeding, AGIB is defined as upper GIB (UGIB), when located proximally to the ligament of Treitz, and lower GIB (LGIB) when it occurs elsewhere in the alimentary tract. The frequency of UGIB has followed a reducing trend over the last 2 decades, probably due to the eradication of *Helicobacter pylori* and the widespread prescription of proton pump inhibitors (PPIs) [3]. More specifically, UGIB is recorded at a rate of 67 cases per 100,000 population in the United States of America [4], 134 per 100,000 population in the UK [5], and 47 per 100,000 in Spain [3]. Similarly, the incidence of UGIB-related deaths has reduced, as indicated by a database study of peptic ulcer bleeding from the US, conducted between 1989 and 2009, which found that the mortality rate had halved, falling from 4.5-2.1% [6]. Although LGIB is more common than UGIB, limited data exist in the literature regarding its prevalence in the general population. Interestingly, the rate of diverticular disease and angiodysplasia-related bleeding has increased, probably reflecting the use of antiplatelets and oral anticoagulants [1,2].

Endoscopic hemostasis represents the mainstay treatment, alongside optimization of medical care. This is supported by studies revealing a reduction in overall mortality caused by GI bleeding. GI endoscopy societies have published thorough guidelines on the management of AGIB, favoring dual hemostasis as the optimal approach in cases of active hemorrhage [7-9]. Mechanical treatment, including a variety of endoscopic clips and bands, provides a reliable and lasting effect, especially when applied to focal lesions and vessels. Similarly, thermal ablation techniques target actively bleeding or high-risk spots with equivalent efficacy. Injection with adrenaline solution provides a combined tamponade and vasoconstrictive effect; however, it is limited by its short duration and needs to be accompanied by another technique [9]. These techniques require fine movements to target the bleeding site, which may be challenging in difficult positions, or when there is a large abnormal surface, as in the case of malignancies.

Combination therapy, including at least 2 of the aforementioned modalities, is strongly recommended by current guidelines and supported by high-quality evidence [8,9]. Although the available modalities offer an adequate effect on hemostasis, single treatment with epinephrine injection is inferior to combination therapies with thermal or mechanical hemostasis. At least in cases with active bleeding, epinephrine injection in the bleeding site, followed by cauterization or clipping, provides lower rates of rebleeding and need for emergency surgery [10,11]. However, in cases with a difficult and unstable endoscopic position, unavailability of sophisticated devices such as over-the-scope clips, and inadequate endoscopic experience, combined hemostasis can be challenging.

Topical hemostatic powders offer a treatment modality that is easy to use, with a minimal learning curve. Therefore,

they provide a promising alternative, especially when a targeted treatment cannot be provided. Additional benefits include the ability to treat a large surface area and their non-contact nature. TC-325 (Hemospray®; Cook Medical, Winston-Salem, North Carolina, USA) is a mineral-based hygroscopic powder that is deployed using a pressurized carbon dioxide canister (Fig. 1). When Hemospray® comes into direct contact with blood it triggers a clotting cascade that results in the formation of a coagulum. This leads to a tamponade effect over the bleeding foci, forming an adhesive seal that results in hemostasis. The powder then sloughs off the mucosa over the following 24-72 h [12]. Although these hemostatic agents seem to yield an acceptable rate of bleeding cessation, they are currently recommended as rescue therapy, rather than primary therapy. The aim of this single-arm, prospective, multicenter international registry study was to evaluate hemostasis outcomes and adverse events in consecutive patients who received Hemospray® as endoscopic monotherapy for AGIB, in various locations and with different underlying causes.

Patients and methods

Study design

A prospective international multicenter study, in form of a registry, was conducted to investigate the efficacy of Hemospray® on AGIB as monotherapy. The Hemospray® Registry was presented to the local research ethics committee (London - South East Research Ethics Committee) and received ethical approval in October 2016 (ISRCTN29594250). A total of 18 centers across Europe and the USA contributed to the registry between January 2016 and February 2022. The study protocol conformed to the ethical guidelines of the last revision of the Declaration of Helsinki and complied with Good Clinical Practice Guidelines [13,14]. Patients' anonymity was ensured and all recruited subjects provided written informed consent to their participation in this trial.

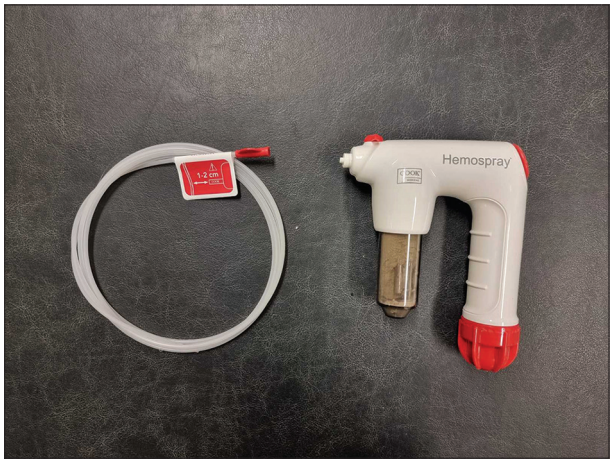

Figure 1 The Hemospray® (TC-325) device

Inclusion criteria

Adult patients with evidence of AGIB were considered as eligible to undergo endoscopic hemostasis with TC-325. UGIB was suspected in patients with melena, hematemesis or Glasgow-Blatchford score ≥1. Cases with hematochezia and abnormal Oakland score were treated as LGIB, unless evidence of UGIB existed (e.g., increased urea, hemodynamic instability). The final decision for enrolment was at the endoscopists' discretion during the endoscopy. Regarding peptic ulcers, only cases with active bleeding in endoscopy were recruited (Forrest Type 1a and Type 1b).

Patients were excluded if they did not consent to participate in the study, had prior failed attempts for hemostasis during the same or a previous session, or when TC-325 was used as part of combined hemostasis (adjunctive to clips or thermocautery).

Procedure

Following resuscitation with intravenous fluids and personalized medical treatment, where needed (e.g., PPIs, red blood cell transfusion), upper or lower GI endoscopy was offered, depending on the suspected area of bleeding. Upon identification of the bleeding site, TC-325 was sprayed on the lesion, using a commercially available system (Hemospray®; Cook Medical, Winston-Salem, North Carolina, USA). This system includes a canister filled with the powder, a 7- or 10-Fr delivery catheter, and a CO_2 pump incorporated in a handle that controls the expulsion of the powder. Once a clear field had been obtained in front of the bleeding site, the working channel of the endoscope was dried with air inflation, followed by the catheter insertion at 1-2 cm from the bleeding lesion. Short bursts were delivered to release the powder under direct vision, until the area was completely covered by the powder. The site was then observed for at least 5 min to assess for immediate hemostasis or the need for complementary treatment.

Data collection

A predefined online platform was used to enter and maintain the records of the enrolled cases, including the variables that were analyzed. Only the primary investigators (NA, RJH) had access to the patients' records across centers.

Outcomes and definitions

Given the different behavior and impact of the potential bleeding causes and the challenges raised by the location, the outcomes were measured depending on the cause (e.g., peptic ulcer, malignancy, iatrogenic bleeding) and the bleeding site (upper or lower GI) in order to identify any potential benefit from TC-325 related to these variables. The primary endpoint was defined as the rate of immediate endoscopic hemostasis using the Hemospray® device. This was defined as

the intraprocedural observation of bleeding cessation within the first 5 min post monotherapy with TC-325, without recurrence on the same session. The 5-min threshold was also used in previous studies, and thus represented a reasonable comparator [15].

Rebleeding rates, diagnosed when clinical hemorrhage (new hematemesis or melena associated with hemodynamic change following index treatment) or a drop in hemoglobin >2 g/L was observed, were considered as a secondary outcome [16,17]. In addition, 7- and 30-day all-cause mortality rates were calculated. As for any interventional procedure, the frequency and the severity of adverse events were also evaluated.

Follow up

A 30-day follow up was agreed, either with a face-to-face clinic review or via telephone consultation, to assess for recurrence or adverse events.

Statistical analysis

Data analysis was performed using the Statistical Package for Social Science Software for Windows (IBM SPSS Statistics, Version 28.0. Armonk, NY: IBM Corp). Continuous variables are presented as mean ± standard deviation, and categorical variables are shown as percentages. We examined the association between the recorded independent variables and the outcomes. Logistic regression was performed in 2 stages. First, the association between each factor and the outcomes was examined separately using a univariable analysis. If several factors showed a statistically significant association with the primary outcomes, we then examined the joint association between the factors as part of a multivariable analysis. Where appropriate we adopted a backwards stepwise selection procedure to omit non-significant variables from the final model. Odds ratios (OR) and their 95% confidence intervals (CIs) were derived from each variable coefficient in the final model. Statistical significance was defined as a P-value ≤0.05 (2-tailed).

Results

One hundred ninety patients were finally included in our cohort and received TC-325 as monotherapy between January 2016 and February 2022. The age ranged between 51 and 81 years, with the median being 66-71 years among subgroups, and the male-to-female ratio was 2:1. In terms of antithrombotics, 15 patients were under aspirin, 8 under clopidogrel, 1 of them on dual antiplatelet therapy, and 17 on anticoagulation, either warfarin or direct oral anticoagulant. Forty patients (21.1%) presented as hemodynamically unstable and underwent endoscopy after initial resuscitation. Immediate hemostasis was achieved in 96.3% (95%CI 92.6-98.5; 183/190) of patients, with an overall recurrence rate of 17.4% (95%CI 11.9-24.1; 28/161), occurring within 14 days from the initial hemostasis. Data on blood units transfused post-hemostasis were available for 52 patients, with a mean number of 0.56 units per patient (range 0-8). Sixteen of 161 patients (9.9%, 95%CI 5.8-15.6) died within 7 days post-hemostasis, and deaths rose to 21.7% (95%CI 15.6-28.9; 35/161) after 1 month.

Four subgroups were identified, including cases with bleeding peptic ulcer (n=48), upper GI malignancy (n=79), post-endoscopic treatment-related hemorrhage (n=37), and lower GI lesions (n=26). Table 1 gives the main data from these subgroups.

Peptic ulcer-related bleeding

Forty-eight patients with Forrest Ia (2/48) or Ib ulcer (46/48) were included, of a total 74 cases with ulcer-related bleeding (Fig. 2). The rationale for Hemospray in this setting is that once it comes into contact with blood it forms a cohesive and adhesive barrier that tamponades the bleeding lesion. This subsequently promotes the concentration of clotting factors and cellular elements that may activate the clotting cascade [18]. In our cohort, immediate hemostasis was achieved in 42/48 patients, equating to a rate of 88% (95%CI 75-95) (Table 2). The Blatchford score was borderline associated with failed hemostasis; every 5-unit increase in the score resulted in a 5-fold increase in the odds of failure (P=0.05).

The secondary outcomes (Table 2) were assessed in 38 patients who attended follow up. Rebleeding was observed in 26% (95%CI 13-43; 10/38) of cases. After the index hemostasis, 7 patients died within 7 days (11%, 95%CI 3-25) and 10 patients within 30 days (26%, 95%CI 13-43; 10/38). Univariate analysis showed that a higher American Society of Anesthesiologists (ASA) score was associated with 30-day mortality. Mortality was 6% in patents with ASA grade 1-2, compared to 44% in those with ASA grade 4-5. The odds of death were 12 times higher for patients with higher ASA grades (P=0.03), and the significance was preserved on multivariable analysis (OR 23.5, 95%CI 1.60-345; P=0.02). Additionally, 40% of patients who died presented as unstable on initial admission, while 4 of them rebled post-Hemospray application.

Upper GI malignancy

Seventy-nine patients with an upper GI cancer were recruited into this subgroup (19 esophagus, 6 esophagogastric junction, 51 gastric, 3 duodenal). The primary outcome was achieved in 100% (79/79) of upper GI malignancy cases, regardless of the location or lesion size.

Rebleeding after primary hemostasis was observed in 12 patients (17%; 95%CI 9-28) of the 69 who had follow-up information available. The median tumour size was 30 mm (interquartile range: 19-50) and there was a tendency for rebleeding among lesions >40 mm (27% vs. 10%), albeit non-significant (P=0.09). The mortality rate after primary

Table 1 Main characteristics of the recruited sample

Characteristics	Peptic ulcer disease (n=48)	Upper GI malignancy (n=79)	Post endotherapy (n=37)	Lower GI bleeding (n=26)
Age, median (IQR), Years	71 (63-78)	69 (58-78)	71 (64-77)	66 (51- 81)
Female, *n* (%)	20 (41.7)	28 (35.4)	7 (18.9)	11 (42.3)
Median Blatchford score	13	10	3	

GI, gastrointestinal; IQR, interquartile range

Table 2 Study outcomes stratified per cause of bleeding

Outcomes	Peptic ulcer disease (n=48)	Upper GI malignancy (n=79)	Post endotherapy (n=37)	Lower GI bleeding (n=26)
Immediate hemostasis	88% (95%CI 75-95)	100% (95%CI 91-100)	100% (95%CI 91-100)	96% (95%CI 80-100)
Rebleed rate	26% (95%CI 13-43)	17% (95%CI 9-28)	3.1% (95%CI 0-16)	23% (95%CI 8-45)
7-day mortality, n (%)	11% (95%CI 3-25)	7% (95%CI 2-16)	3.1% (95%CI 0-16)	14% (95%CI 3-35)
30-day mortality, n (%)	26% (95%CI 13-43)	25% (95%CI 15-36)	3.1% (95%CI 0-16)	32% (95%CI 14-55)

GI, gastrointestinal; CI, confidence interval

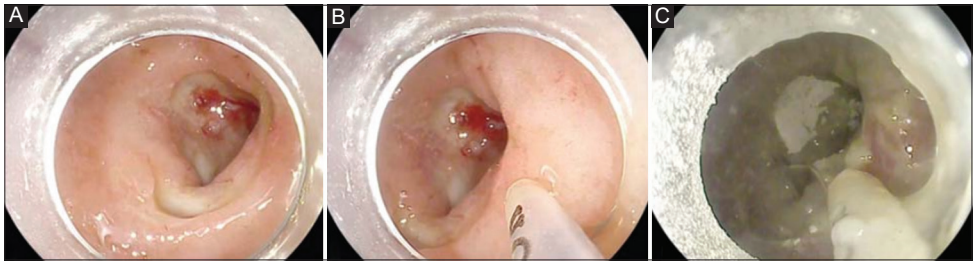

Figure 2 Bleeding peptic ulcer (Forrest Ib) (A), with TC-325 application (B) and immediate hemostasis (C)

hemostasis among those followed-up (N=69) was 7% (95%CI 2-16; 5/69) within 7 days, and 25% (95%CI 15-36; 17/69) within 30 days, with 5 of these patients presenting with recurrence of bleeding. Hemodynamic instability was associated with 9-fold higher 30-day mortality compared to those with hemodynamic stability (OR 8.89, 95%CI 1.58-49.9; P=0.01).

Post-upper GI endoscopic therapy

Post-procedure bleeding was diagnosed and treated with TC-325 after various procedures, as presented in Fig. 3. An optimal rate of immediate hemostasis was achieved (100%, 95%CI 91-100; 37/37), for all of the different procedures. Only 1 case of endoscopic mucosal resection (EMR) (3.1%, 95%CI 0-16; 1/32) presented with rebleeding; the defect was 50 mm and the resected lesion 22.5 mm. One patient died within the first thirty days (3.1%, 95%CI 0-16; 1/32].

LGIB

A total of 26 patients received Hemospray® for LGIB, with 12 of them (46.2%) having an underlying lower GI malignancy as the cause of bleeding, and in all but one the primary outcome was achieved (96%, 95%CI 80-100; 25/26). Follow-up information was available in 22 cases with a rebleeding rate of 23% (95%CI 8-45; 5/22). The univariable analysis revealed that age and hemodynamic status were significantly associated with rebleeding. More specifically, for every 10-year increase in age the risk of rebleeding was reduced by one fifth (P=0.03), while it was 18 times higher in patients who were hemodynamically unstable compared to those who were hemodynamically stable (P=0.04). Post-hemostasis, mortality was 14% (95%CI 3-35; 3/22) within the first 7 days and 32% (95%CI 14-55%; 7/22) within the first 30 days; none of the factors included in our regression models was linked with 30-day mortality; however, all but 1 had underlying malignancy and only 2 of them rebled.

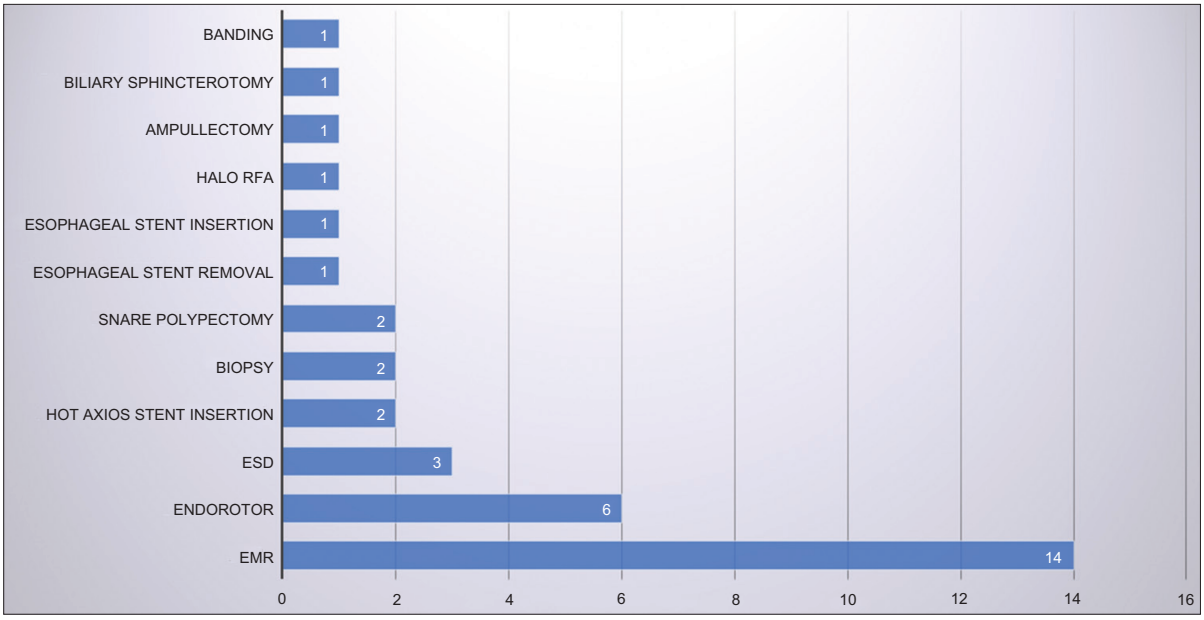

Figure 3 Causes of gastrointestinal bleeding post-endoscopic intervention
ESD, endoscopic submucosal dissection; EMR, endoscopic mucosal resection

Adverse events

A single complication was reported in the registry, with the endoscopist reporting catheter blockage during the treatment of a duodenal ulcer. Despite this, immediate hemostasis was achieved and there were no reports of rebleeding.

Discussion

This prospective multicenter registry assessed the efficacy of Hemospray® as monotherapy. Immediate hemostasis was achieved in 88-100% across a range of GI bleeding scenarios. The highest rates were recorded in bleeding related to malignancy and post-endoscopic intervention, where TC-325 was universally successful. Interestingly, these 2 subgroups were associated with the lowest rates of recurrent hemorrhage (17% and 3.1%, respectively), whereas one fourth of peptic ulcers and LGI lesions rebled. A recent meta-analysis assessed the pooled rates of 19 studies, including 212 cases where Hemospray® was used as monotherapy. Their outcomes were similar to ours, with an immediate hemostasis rate of 91% (95%CI 79-96), regardless of the combined use with other modalities, the intensity of bleeding, and its cause. The early rebleeding rate was 21% (95%CI 14-31), which is higher than the 17.4% (95%CI 11.9-24.1) observed in our registry across all scenarios [19]. Within the first month after hemostasis, the mortality among patients treated for a peptic ulcer or upper GI malignancy was 25%, which was higher among those with an advanced ASA score or hemodynamic instability. Only 1 patient died post-EMR, whereas the higher mortality rates were detected among patients with LGIB; however, none of the evaluated variables was associated with this outcome. Finally, TC-325 monotherapy was an extremely safe treatment, with only once adverse event reported secondary to catheter blockage. In 2023, a Field Safety Notice was released regarding adherence of the endoscope to the hemostatic powder while deployed in a retroflexed position, but this was not seen in our registry.

Treating active peptic ulcer-related bleeding requires at least 2 hemostatic techniques, and hemostatic powders, such as TC-325, are considered for refractory or recurrent cases [9]. Hemospray® monotherapy yielded bleeding cessation in 88% (95%CI 75-95) of cases; however, the recurrence rate was considerable (26%, 95%CI 13-43), accompanied by a similarly high mortality rate within the first month (26%, 95%CI 13-43). Interestingly, a high ASA score, reflecting the patients' comorbidities and perioperative risk, was an independent predictor of mortality, with an OR of 23.5. We have previously shown, in a study of 202 patients who received Hemospray® monotherapy (25%), combination therapy (75%) or Hemospray® rescue therapy (25%), that the overall rate of hemostasis was 88%, with no difference among subgroups. Similarly, there was no difference in rebleeding rates (17%) and early mortality (12%); however, the 1-month mortality rates were significantly lower when a combined hemostasis approach was applied, compared to monotherapy (P<0.001) [15]. Despite the theoretical risk of failure and rebleeding in cases with spurting hemorrhage (Forrest Ia), it is not uniformly supported by the literature [15,20]. The high rates of immediate hemostasis and the non-inferiority for this outcome compared to the combined approach, reveal a significant role for TC-325 in achieving a direct effect on the active bleeding site. This is especially true when combined hemostasis cannot be achieved, as in the case of a difficult position, a marginally stable patient or an unclear field. Hemospray® could be used in these cases as a bridge therapy, to gain time with primary control before a second-look endoscopy, especially when resources are limited, or when the patient needs to

be transferred to another center for definitive treatment. However, the significantly higher rates of mortality in monotherapy cases with comorbidities imply a need for confirmation of hemostasis with a second endoscopy and complementary treatment where needed. Potential causes associated with these rates need to be assessed by future studies, thereby evaluating the clinical approach policies post-hemospray monotherapy for peptic ulcer, including restarting feeding, transfusion policy and continuation of antithrombotics.

Malignancy-related bleeding is notoriously difficult to treat, given the lack of a direct target for endotherapy, the tumour tissue's friability, the diffuse bleeding and the absence of a single bleeding vessel [19,21]. The wide field of treatment during the application of Hemospray makes it a helpful endoscopic option for this indication [21], and we have shown that immediate hemostasis can be achieved in 100% of cases. Similar studies provide equivalent results regarding immediate efficacy [22-24]. Additionally, TC-325 significantly reduces the required transfusions in this patient group [24]. A recent randomized controlled trial randomized 106 patients with GI malignancy bleeding to receive monotherapy with Hemospray® or the standard treatment (thermal or mechanical modalities or adrenaline injection alone or in combination). Immediate hemostasis rate was significantly higher using Hemospray® compared to the conventional techniques (100% vs. 68.6%; P<0.001) and, more interestingly, the Hemospray® group also had lower recurrence rates (2.1% vs. 21.3%; P=0.003). However, we should note that up to 20% of the standard treatment cohort were managed with epinephrine therapy alone [25]. In our cohort, rebleeding occurred in 17% of cases with lesions larger than 4 cm, presenting a non-significant tendency for recurrence; however, data on variables affecting this outcome (e.g., morphology, location of the lesion, coagulation status) need to be elucidated by future studies. Considering mortality, a small number of patients (7%) died during the first week, though this rate increased over a month, especially among patients who presented with hemodynamic instability. This outcome shows heterogeneity in the literature, ranging between 18.9% and 44.9% within 30 days post bleeding, with active bleeding during the endoscopy increasing the risk of death by 2.24 [26,27].

Another area where Hemospray® could represent a reliable choice as monotherapy is post-endoscopic intervention bleeding. In our cohort, immediate hemostasis was yielded in all bleeding cases, while only 1 patient exhibited recurrence. This single incident occurred following colonic EMR, where the lesion was 50 mm in size [28]. Similar results of optimal hemostasis were also presented by our group in a related study, with recurrences occurring in 2 post-EMR patients of 57 (4%) [29]. Data on the performance of Hemospray® in LGIB are limited; however, it appears equivalent to UGIB [19]. Although immediate bleeding cessation was achieved in almost all of our patients, the recurrence rate was relatively high (23%, 95%CI 8-45%), probably reflecting a persistent LGIB etiology in most cases, such as diverticular disease. Finally, TC-325 is already established in terms of safety, with the most common adverse event being catheter blockage.

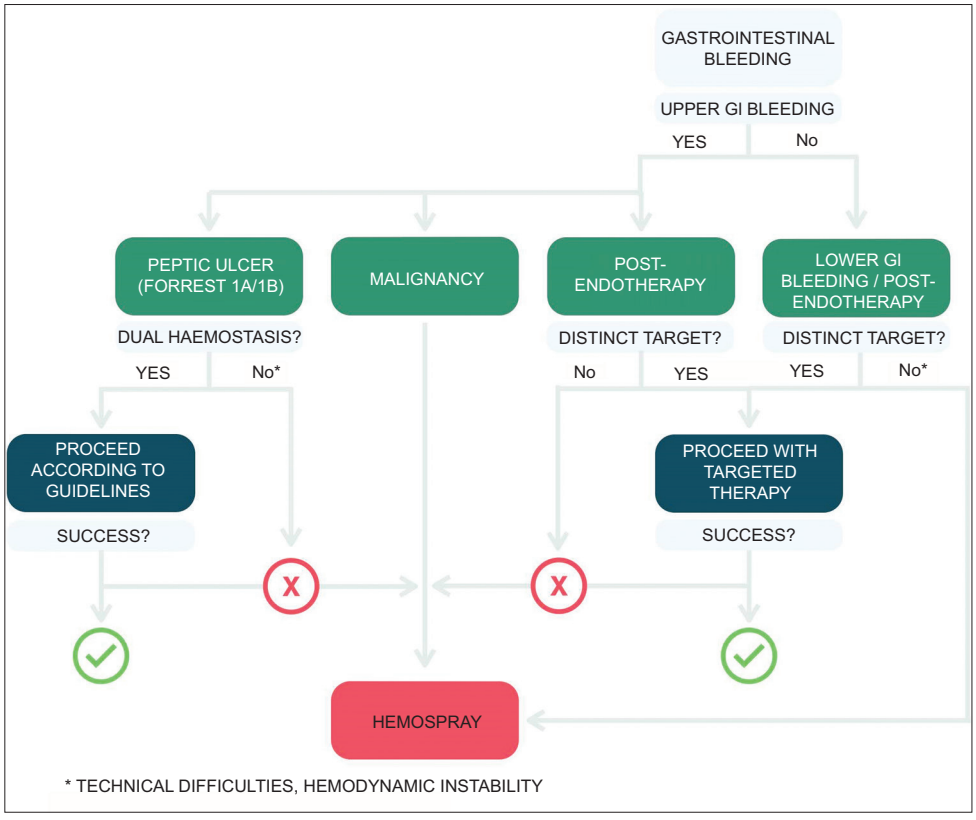

Figure 4 Proposed algorithm for Hemospray® use in gastrointestinal (GI) bleeding

The most significant limitation of this multicenter prospective registry study is its non-randomized design with no comparator, thus not allowing the evaluation of TC-325 compared to the current standard of care. In specific subgroups, such as post-intervention bleeding, the sample size was too small to identify potential confounders related to the type of intervention, whereas its effect on variceal bleeding was not assessed. Patient selection for monotherapy use was at the discretion of the endoscopist, as opposed to a set criteria/protocol, which potentially introduced an element of selection bias. Furthermore, excluding patients who underwent combination therapy with other endoscopic modalities could obscure the true efficacy of Hemospray® monotherapy. This is because initial use with a hemostatic powder may have required salvage intervention during the same procedure; salvage treatment following recurrence is also under-reported. Moreover, detailed aspects regarding the macroscopic features of bleeding lesions or histological diagnosis regarding malignancy were not extracted, which could have impacted our outcome measures. A significant drawback is the fact that the exact cause of death for patients was not documented, meaning that we cannot directly associate rebleeding or immediate hemostasis with mortality.

Endoscopic hemostasis using the TC-325 powder as monotherapy is safe and effective, especially in hemorrhage due to malignant lesions or post-endoscopic intervention (Fig. 4). In peptic ulcer-related bleeding it could achieve immediate results when the standard-of-care combined treatment is not feasible, allowing more time to optimize a patient's condition and make a definite plan. In these cases, a second-look endoscopy could be considered to confirm the outcome and intervene when necessary; however, this approach needs to be evaluated further.

Summary Box

What is already known:

- TC-325 represents a safe and efficient technique for hemostasis
- Current guidelines suggest the use of Hemospray® as adjunctive to standard treatment

What the new findings are:

- Hemospray® can provide high rates of immediate hemostasis in actively bleeding peptic ulcers, thus providing satisfactory hemostasis as a bridge to definitive therapy
- A high American Society of Anesthesiologists score is associated with higher mortality rates in patients with bleeding peptic ulcers
- Hemospray® can be used as first-line treatment for bleeding tumors with relatively low rebleeding rates over a 30-day follow up
- Bleeding consequent to endoscopic interventions can be successfully treated with Hemospray® monotherapy

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