

Research of Gastric Management and Hepatology

Case Report

Transcatheter Embolization for The Control of Upper Digestive Bleeding

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Abstract

Digestive bleeding (GDHB) is a relevant clinical problem. Digestive bleeding is self-limiting in 80%, but with a mortality rate between 6 and 10%. Transcatheter embolization, also known as embolization therapy, has evolved as a key therapeutic technique in the management of upper gastrointestinal bleeding (UGIB), especially in those cases refractory to endoscopic treatment.

Clinical case: 73-year-old female patient with one day of evolution of 3 episodes of melena. In 2019 and 2022 she was hospitalized for digestive bleeding requiring an ICU stay and the use of multiple blood transfusions, a mesenteric vessel angiography (celiac trunk) in 2019 was reported as normal. The 2019 EVDA was found to be normal. Another endoscopy in 2022 reported a minor curve ulcer in the healing process. Because re-bleeding occurred and the EVDA did not locate the bleeding site but reported blood in the stomach and duodenum, mesenteric vessel angiography was requested. The angiography reported hypervascular blush in the topography of the short gastric, gastroepiploic and left gastric arteries, treated with embolization of the left gastric and gastroduodenal arteries with coils and microparticles. The patient progresses without bleeding and is discharged on the eleventh day of hospitalization.

CONCLUSION: The international clinical practice guidelines for upper gastrointestinal bleeding (UGIB) recommend: In patients with persistent bleeding that does not respond to standard endoscopic hemostasis modalities, consider transcatheter embolization (TAE) as the next therapeutic option. If TAE is not available locally or fails, surgery should be considered as an alternative.

Introduction

Upper gastrointestinal bleeding (UGIB) is a relevant clinical problem. 80% of gastrointestinal bleeding is self-limiting, but the mortality rate is between 6 and 10%. Its study and treatment requires a multidisciplinary approach involving gastroenterologists, radiologists and surgeons. The problem of persistent bleeding after endoscopic treatment, which is a low percentage, represents a diagnostic challenge in terms of its location and cause. The selection of the most appropriate diagnostic and therapeutic method is what will contribute to reducing morbidity and mortality, shortening hospitalization time and reducing transfusion requirements.

Upper gastrointestinal endoscopy is considered the technique of choice for UGIB, since it allows the bleeding lesion

to be located and treated (thermal coagulation, epinephrine injection, clips, bands or argon-plasma fulguration). This technique has a sensitivity of 92-98% and a variable specificity of 30-100%. In approximately 10 to 24% of cases of acute UGIB, a diagnosis is not reached and, of course, appropriate therapy will not be achieved [1,2]

Transcatheter embolization, also known as embolization therapy, has evolved as a key therapeutic technique in the management of upper gastrointestinal bleeding (UGIB), especially in those cases refractory to endoscopic treatment.

The development of transcatheter embolization in the specific context of upper gastrointestinal bleeding began to consolidate in the mid-twentieth century.

The first transcatheter embolization for upper gastrointestinal bleeding was performed by Josef Rösch in 1972, when emergency upper gastrointestinal endoscopy had not been widely adopted and was performed on a 43-year-old patient with cirrhosis due to alcohol and bleeding from duodenal ulcers and the pyloric area; In the control angiographies, a 5 cm occlusion was found in the gastroepiploic artery just where extravasation had been previously found. [3,4,5]

In the last three decades, angiographic interventions have become an important therapeutic option in the treatment of non-variceal upper gastrointestinal bleeding. Transcatheter intervention is based on mechanical occlusion of the arterial supply responsible for the bleeding.

Regarding the studies that precede angiography in case of failure of endoscopic treatment, computed tomography angiography (CTA), with a sensitivity of 86% in the diagnosis of ADH, can specify the location and etiology of bleeding and facilitate the angiographic procedure in case of absence of hemodynamic instability. [11,13,15]

It has been the appearance of microcatheter technology that has positioned transarterial embolization as a safe and effective management, by allowing more selective administration of the embolic agent at the bleeding site [4,7,8].

The transcatheter embolization (TAE) technique for refractory non-varicose UGIB has reached a high level of precision and efficacy thanks to advances in catheters, embolic agents and image guidance. The steps followed for the development of the technique are: Angiography, which is the basis of the technique, especially in cases of intermittent bleeding, is accompanied by other images such as endoscopic and computed angiography (CTA) to guide the procedure and select the affected arteries, such as the left gastric or gastroduodenal arteries. In cases where the site is not evident, the use of endoscopic findings or guidance by metal markers used (clips) during endoscopy allows for orienting embolization. [4,7,8,17]

The next step is the vascular approach for which transfemoral access is used with 5-French catheters and coaxial microcatheters, which allows for superselective embolization and minimizes the risk of arterial spasms or damage to adjacent vessels.

Modern microcatheters are flexible and hydrophilic coated, facilitating access to distal vessels.

The third and final step is the use of embolic agents, the following are usually used: Metal coils: Used to occlude large vessels, they offer precise flow control and low risk of distal ischemia; Liquid materials (NBCA (cyanoacrylate) Onyx®): Ideal in cases of massive hemorrhage or in patients with coagulopathies, due to their rapid hemostasis capacity; Gelatin sponges and microspheres are frequently combined with permanent agents to maximize efficacy and reduce recanalization.[12]

As for strategies to avoid the risk of ischemia, superselective embolization and the "sandwich" technique are used, which

consists of embolizing both the entrances and exits of the affected vessel, preserving collateral vascularization.

Clinical Case

Reason for consultation: Melena. (Oct 18, 2024)

Current illness: 73-year-old female patient from and coming from Villavicencio (Meta), Colombia, with a day of evolution of 3 episodes of melena associated with diaphoresis, dyspnea, and dizziness, has not presented vomiting. History: High blood pressure, treated with Losartan 50 mg BID. In 2019 and 2022, she was hospitalized for digestive hemorrhage requiring an ICU stay and the use of multiple blood transfusions. An angiography of the mesenteric vessels (Celiac trunk) in 2019 was reported as normal. The EVDA in 2019 was found to be normal. Another endoscopy in 2022 reported a 2cm long proximally located ulcer of the lesser curve in the healing process.

On admission: Lying down, BP 123/75 mm Hg, HR: 80 BPM, RR: 20 RPM, T: 36°, SATO2: 97%, FIO2 21%, moderate skin pallor, and the rest of the examination was normal.

Hb: 10.5 g/dl and BUN 57.8 mg/dl

During the following two days, the melena persisted and the Hb dropped to 7.6 g/dl

On the third day of admission, an upper gastrointestinal endoscopy (UGE) was performed: which showed fresh blood in the stomach and duodenum, but the origin of the bleeding could not be located.

On the fourth day, the Hb was 7.2 g/dl and the patient showed signs of hemodynamic instability due to hypotension, tachycardia, and diaphoresis, despite several red blood cell transfusions. Since the patient was bleeding again and the endoscopy had not been able to locate the bleeding, but it was presumed to be of stomach or duodenal origin, mesenteric vessel angiography was requested, with the aim of diagnosing and treating the bleeding.

The study was justified by: 1) Multiple episodes of upper gastrointestinal bleeding. 2) Requirement of multiple red blood cell transfusions. 3) Hemodynamic instability. 4) Endoscopy could not locate the bleeding site.

After informed consent, vascular access was performed via the right femoral artery with a 5 Fr hydrophilic cobra catheter and angled guidewire. Of 0.035 x 150 cm, catheterizing the celiac trunk, iodinated contrast medium was used, evidencing hypervascular blush in the topography of the short gastric, gastroepiploic and left gastric arteries, so it was decided to perform occlusion of the short gastric arteries with one coil and the gastroduodenal artery with two coils, after which endovascular embolization with PVA 500-700 microparticles was performed. Dx Upper gastrointestinal bleeding treated with embolization of the left gastric and gastroduodenal arteries.

The patient experienced an improvement in her hemodynamic status in the following 6 days of her hospitalization

and on day 11 of her admission the hemoglobin was 10.1 gr / dl. With hemodynamic stability and tolerating the oral route, for which she was discharged.

There are multiple studies on the use of TAE in upper gastrointestinal bleeding that rebleeds after endoscopic treatment. One of them is that of Spiliopoulos et al. (2018) is a multicenter and retrospective analysis that evaluated the results of treatment with transcatheter arterial embolization (TAE) in patients with upper gastrointestinal bleeding (UGIB) of non-variceal origin secondary to peptic ulcers. In which 44 patients treated in five European centers after failures in endoscopic hemostasis were included.

Cases were selected by: Active bleeding confirmed by endoscopy or computed tomography angiography (CTA) pre-procedure, gastric or duodenal ulcers, failure in initial endoscopic hemostasis, hemodynamically unstable patients, provided they achieved stabilization after initial resuscitation with fluids and inotropes.

Group characteristics: Average age: 74 years (range: 49–94), Bleeding location: Duodenal: 81.8% (36/44), Gastric: 18.2% (8/44). Common comorbidities: Coronary artery disease (56.8%), respiratory disease (22.7%), and malignancies (15.9%).

In 42 of the 44 patients, CTA was performed before the procedure to confirm the bleeding site and plan embolization. Two patients, with massive bleeding evident on endoscopy, were taken directly to angiography. Vessels treated: Gastroduodenal artery: 86.4%, Left gastric artery: 13.6%. and Branch of the superior mesenteric artery: 11.4%. Materials used: Coils or microcoils: 50%. Combinations of coils with glue, microparticles or gelatin foam: 31.8% and glue alone: 11.4%.

The predominant technique was superselective embolization using 2.6-2.7 Fr catheters.

Regarding the results: 100% technical success (confirmed occlusions with no residual bleeding at the end of the procedure). Significant increase in post-procedure hemoglobin levels (from 7.27 g/dl to 9.66 g/dl, $p < 0.0001$) and re-bleeding in only 2 patients (4.5%), successfully managed with reembolization or gastrectomy. 30-day survival: 79.5% and long-term survival: 71.9% (maximum follow-up 3.5 years). [18]

This technique was used in the clinical case presented in this review with a favorable technical result for the patient.

Lofroy presented a study comparing TAE with at least two methods to achieve bleeding control, finding that the use of coils alone was significantly associated with a higher risk of early rebleeding. According to multivariate analysis, the odds ratio (OR) for rebleeding with coils was 20.4 (95% CI: 10.13–50.14; $p = 0.024$). In contrast, the use of Glubran®2 (NBCA) showed an inverse association with early rebleeding, with an OR of 0.47 (95% CI: 0.22–0.99; $p = 0.047$), suggesting that this agent is more effective in preventing rebleeding [14]

Regarding the predictive factors of rebleeding using TAE, it

has been found that: Having two or more comorbidities was an independent predictor of early rebleeding, with an OR of 20.14 (95% CI: 10.01–40.52; $p = 0.047$). This underlines the importance of the patient's general condition in clinical outcomes.

A lower initial hemoglobin level was the only significant predictor of 30-day mortality in the multivariate analysis, with an OR of 10.38 (95% CI: 10.10–10.74; $p = 0.006$). This finding highlights the initial severity of the patient's condition as a critical factor.[14]

In the meta-analysis by Matsumoto, the use of coils and NBCA for transcatheter embolization in non-variceal gastrointestinal bleeding showed similar technical success rates, with an average of 94.9% for initial embolization.[13]

NBCA is more effective in controlling bleeding in patients with severe coagulopathies or in small and difficult-to-access vessels, due to its immediate occlusion capacity.

Regarding safety, coils have a slightly higher safety profile due to their non-adhesive nature, which reduces the risk of unwanted embolization. NBCA poses a higher risk of complications if not handled accurately, including accidental embolization to distal vessels.[13]

Patients treated with NBCA have lower rebleeding rates compared to coils, especially in massive and persistent hemorrhages. This is attributed to the definitive nature of NBCA in completely sealing bleeding vessels.[13]

The use of NBCA tends to reduce the total procedure time due to its rapid action and its ability to seal vessels even with significant active flow.

This meta-analysis is limited by the heterogeneity of the included studies, most are retrospective, with reduced sample sizes, and there is also heterogeneity of the embolic agents used.[13]

Hur studied the use of TAE depending on whether the origin is stomach or duodenum finding that: The mean procedure time was significantly longer in the duodenal bleeding group (54.2 minutes) compared to the gastric group (41.6 minutes, $p = 0.004$). This reflects the greater technical complexity in addressing duodenal bleeding. Micro catheters with a 2.0-F tip proved to be especially useful in duodenal bleeding, where better clinical results were observed (odds ratio [OR] = 7.389, $p = 0.005$). This effect was not observed in the gastric group. In gastric bleeding, the most frequently approached vessels were the left and right gastric arteries, while in duodenal bleeding, the gastroduodenal and pancreaticoduodenal arteries were predominantly involved. In both groups, N-butyl-cyanoacrylate (NBCA) mixed with ethiodized oil was predominantly used, due to its ability to rapidly occlude bleeding vessels and minimize recanalization. Efficacy was similar in both groups, but was managed with greater caution in the duodenal to avoid ischemic complications due to the complex collateral network. Rebleeding was more common in the duodenal bleeding group (37.8%) compared to the gastric group (20.6%, $p = 0.025$). [15]

The systematic review study conducted by Ini' Corrado et al. (2023) focuses on evaluating the technical and clinical results of transcatheter embolization (TAE) in the treatment of upper and lower gastrointestinal bleeding.

It defines the technical result as: The correct release of the embolic material with angiographic evidence of the occlusion of the target arteries and the absence of signs of bleeding at the end of the procedure. The average technical success rate: 97.7% (range 62%-100%), based on an analysis of 783 patients in 27 studies.

Defines clinical outcome as: The absence of obvious signs of bleeding (on imaging, laboratory tests, or clinical findings) during the minimum follow-up period of 30 days.

Average clinical success rate: 80% (range 51%-100%) in the 27 studies.

The predominance of retrospective studies and the absence of robust randomized trials limit the ability to establish definitive recommendations.[7]

There are few comparative studies between performing treatment of upper gastrointestinal bleeding with either embolization (TAE) or surgery. L. Erikson in a series from 1998 to 2005 with 658 cases found 91 (13.82%) patients with recurrent upper gastrointestinal bleeding despite endoscopic treatment.

A group of 40 patients were treated with TAE (Transcatheter Embolization) and another of 51 with surgery. The selection of the groups was determined by the availability of equipment and trained personnel at the time of the study.

Of the group treated with TAE, 33 had duodenal ulcer, 5 with gastric ulcer, and two with gastric and duodenal ulcer. Of the group treated with surgery, 11 had gastric ulcer, 32 had duodenal ulcer, 4 had stoma ulcers, and 4 had Dieulafoy's lesion. The result after treatment showed recurrence of bleeding in 18% of those treated with surgery and 25% of those treated with TAE.

Of those who recurred after surgery, they were treated with TAE and bleeding was controlled in 88% (8/9). Of those treated with TAE and recurred, control was achieved with the second session of TAE in 5. The other 5 underwent surgery, and it was found that 1 had ulceration on the Dieulafoy lesion, 2 had ulceration and bleeding, 1 underwent a B II and 1 had no source of bleeding.

Regarding complications, 80% of those treated with TAE had no complications and 1 died at 30 days of follow-up. The complications described were not directly related to the procedure and the cause of death was not recorded. Among those operated on, 63% had no complications, 7 died at 30-day follow-up and 6 complications were directly related to surgery. In his analysis, he recognized lower morbidity and mortality in the TAE group (3%) compared to the surgical group (14%), with the TAE group being on average older (76 years) compared to 71 years in the surgical group [9]

In Ripoll's comparative study between TAE and surgery on 1350 cases from 1986 to 2001, 85 cases of failure to control

bleeding after endoscopic treatment were presented, representing 6.2%.

Of the cases with post-endoscopic rebleeding, 31 underwent TAE and 39 underwent surgery; the remaining 15 cases are not assigned. This study is retrospective and there is no random selection for each procedure. It should also be noted that the inclusion time is long and in this period of time, endoscopic treatment techniques have changed for the better, and the introduction of pharmacological treatment with proton pump inhibitors has also improved the clinical response, as well as the radiological approach techniques. Taking into account these limitations, no differences were found in this study regarding recurrence of bleeding or deaths between the two treatment techniques. [10]

Kaminkis published a prospective study in which he analyzed the use of TAE but in a preventive manner (p-TAE) selecting patients with bleeding peptic ulcers classified as Forrest IA, IB, IIA or IIB, who had a Rockall scale ≥ 5 , which indicated a high risk of re-bleeding and the presence of critical comorbidities that increased the risk of postoperative mortality, such as cardiovascular, renal or hepatic diseases. In total, he selected 58 patients and compared them with those treated only with endoscopy (EA), a total of 341.

The percentage of re-bleeding in p-TAE was 3.4% while in EA it was 16.2%. The need for surgery in the p-TAE group was 10.3% and in the EA group 20.6% $p=0.06$. Mortality. In the p-TAE group. It was 5.7% and in the EA group it was 8.5% $p=0.417$

p-TAE is an effective and safe strategy for high-risk patients after initial endoscopic hemostasis. This approach significantly reduces rebleeding rates and stabilizes patients, minimizing the need for emergent surgical interventions. However, the lack of randomization represents an important limitation for the generalization of these findings.[16]

After reviewing retrospective studies, some prospective studies and technical considerations of TAE, it is important to establish the recommendations of clinical practice guidelines. The European Society of Gastrointestinal Endoscopy (ESGE) 2021 issues the following specific recommendations for the use of TAE in the management of non-variceal upper gastrointestinal bleeding:

Indication for TAE: In patients with persistent bleeding that does not respond to standard modalities of endoscopic hemostasis, it is recommended to consider transcatheter embolization (TAE) as the next therapeutic option.

If TAE is not available locally or fails, surgery should be considered as an alternative.

In the management of recurrences: In patients with clinical evidence of recurrent bleeding, a second endoscopy with haemostasis is recommended if necessary. If this second endoscopic intervention fails, TAE should be proceeded with before considering surgery.

Level of Recommendation

Strong recommendation with moderate quality evidence. This reflects the overall efficacy of TAE in controlling refractory bleeding, but also limitations in terms of availability and potential complications.[19]

Conclusions

The transcatheter embolization (TAE) technique for refractory non-variceal UGIB has reached a high level of accuracy and efficacy thanks to advances in catheters, embolic agents and imaging guidance.

The European Clinical Practice Guidelines recommend: In patients with persistent bleeding unresponsive to standard modalities of endoscopic haemostasis, transcatheter embolization (TAE) is recommended to be considered as the next therapeutic option.

If TAE is not available locally or fails, surgery should be considered as an alternative.

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