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Clinical Outcome of Superselective Transarterial Embolization for Acute Colonic Gastrointestinal Bleeding: A Retrospective Single-Center Experience

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Abstract

Objective The aim of the study was to assess the safety and efficacy of transarterial embolization in the treatment of acute lower gastrointestinal hemorrhage (LGIH) from colonic origin and to determine factors that influence the treatment outcome.

Methods This retrospective study included 32 patients (mean age: 37.5 years; 24 males) of acute LGIH with a colonic source diagnosed on conventional angiography between March 2014 and May 2023. The clinical characteristics at presentation, laboratory findings, etiology of bleeding, angiographic findings, and embolization details were assessed and correlated with outcomes comprising success rates of embolization, complications, recurrence (immediate and late), and mortality.

Results Embolization was technically successful in 27 patients (84.4%) and clinically successful in 24 patients (75%). Embolic agents used were coils ($n = 12$), n-butyl cyanoacrylate glue ($n = 8$), Gelfoam ($n = 4$), polyvinyl alcohol (PVA) particles ($n = 2$), and a combination of coils and glue ($n = 1$). Major complications were seen in five patients (15.6%) including artery dissection ($n = 3$) and catheter impaction and fracture ($n = 2$). Sixteen patients (50%) died after a mean period of 8.3 ± 8.8 days mostly due to septic shock related to the underlying cause. Immediate recurrence was observed in five patients (15.6%) after 3.8 ± 1.6 days of embolization and late recurrence in one patient (3.1%) after 76 days. Both univariate and multivariate analyses showed that acute pancreatitis as etiology was significantly associated with mortality ($p < 0.05$). No other parameters showed any significant association with outcomes.

Conclusion Transarterial embolization is safe and effective in the treatment of acute LGIH due to a colonic source. The etiology of acute pancreatitis is significantly associated with increased mortality.

Keywords
- lower GI bleed
- transarterial intervention

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Introduction

Lower gastrointestinal bleeding (LGIB) is defined as abnormal bleeding originating distal to the ligament of Treitz. The annual incidence of acute LGIB ranges from 20.5 to 27 per 100,000 adults in the general population and is more common in elderly people having various comorbidities requiring anticoagulation or antiplatelet drugs.[1] The origin of LGIB is more commonly the colon than the small intestine, and the causes include diverticulosis, infectious and ischemic colitis, colonic tumors, and arteriovenous malformation.[2–4]

Acute LGIB originating from the colon is usually managed conservatively with supportive care and is successful in a majority (75–85%) of cases.[4] Proctosigmoidoscopy or colonoscopy is considered the initial investigation of choice in such a setting as it offers the advantage of diagnosing malignancies as well as treating venous sources of bleeding. However, in patients with massive LGIB and hemodynamic instability, it is associated with a higher risk and lower diagnostic accuracy due to lack of colonic preparation and the source of bleeding being obscured by blood-filled field of view and residual feces.[5,6] Due to the advancements in technology, computed tomography (CT) angiography is increasingly being used in colonic acute LGIB to detect and localize the source of bleeding with high accuracy.[7–9] The limitations of colonoscopy in such a setting also reduce its treatment success rates in acute LGIB.[10] Surgery carries high morbidity as acute LGIB due to colonic causes would warrant a colectomy.[11]

Transarterial embolization is a safe treatment option in comparison to surgery in colonic acute LGIB.[2] The published studies have shown varying technical and clinical success rates of endovascular embolization for all-cause acute LGIB, ranging from 89.5 to 100% and 68 to 90%, respectively.[12] Further, embolization of the arterial supply to the colon potentially increases the risk of colonic necrosis, ranging from 0 to 5% depending on the site of embolization and the type of embolic agent.[13,14] There is a paucity of data on the factors predicting the outcomes of embolization for acute colonic bleeding. This study aimed to assess the safety and efficacy of transarterial embolization in the treatment of acute LGIB from colonic origin and to determine the potential factors that influence the treatment outcomes.

Materials and Methods

This retrospective study included all patients who underwent endovascular intervention for acute LGIB from colonic arterial origin in our department between March 2014 and May 2023. The study was approved by the institute's ethics committee and the requirement for informed consent was waived. The inclusion criteria were patients presenting with acute LGIB who underwent endovascular embolization for bleeding identified from a colonic artery. The exclusion criteria were lack of clinical information and nonavailability of embolization details from medical records.

The clinical data were collected from the institute's medical record section and electronic database and included demographics, clinical presentation, hemodynamic status at presentation, laboratory parameters, angiography and embolization details, and outcomes of embolization. The workflow in the management of such patients presenting with acute LGIB practiced at our institute has been compiled in ►**Fig. 1**.

The follow-up details (history of recurrence of bleeding, colicky pain, abdominal distension, constipation) were collected based on the clinical assessment on subsequent visits of the patients to the outpatient clinics or through communication over the telephone. At presentation, patients with hypotension (systolic blood pressure of $<$90 mm Hg) and tachycardia (heart rate of $>$100/min) were considered hemodynamically unstable.[15] Blood loss was assessed by measuring the hemoglobin concentration at presentation and the amount of blood transfused before embolization. Patients requiring at least 4 units (1 unit = 450 mL) of blood within 24 hours were considered as having significant bleeding.[15] Coagulopathy was diagnosed if the international normalized ratio (INR) was greater than 1.5 or prothrombin time greater than 4 seconds of reference value. Thrombocytopenia was diagnosed if the platelet count was less than 80,000/mm^3.[12] Further, information about pre-angiographic endoscopy, surgery, and diagnostic CT angiogram was collected. The angiographic data were retrieved from the departmental picture archiving and communication system.

All digital subtraction angiography (DSA) and embolization procedures were performed on Allura Xper FD20 (Philips Healthcare, Amsterdam, the Netherlands) or Artis Zee (Siemens Healthineers, Erlangen, Germany) by a team of two interventional radiologists with 6 and 15 years of experience, through the transfemoral approach. Nonselective angiograms of the superior mesenteric and/or inferior mesenteric arteries were performed initially to identify the source artery. The internal iliac artery angiography was performed when a rectal source of bleed was suspected. Subsequently, the feeding artery was superselectively catheterized with a 2.7-Fr microcatheter (Progreat, Terumo, Shibuya, Japan). The tip of the microcatheter was advanced as close to the bleeding site as possible. The embolic agents were chosen based on the type, morphology, location of the lesion, and personal experience. The agents used were microcoils (►**Fig. 2**), n-butyl cyanoacrylate (NBCA) glue (►**Fig. 3**), Gelfoam, polyvinyl alcohol particles, or a combination of these agents. After embolization, both selective and nonselective angiograms were performed to confirm the exclusion of the lesion from the circulation.

Following the procedure, the patients were observed for any complications and recurrence of bleeding. They were followed up initially until either discharge from the hospital or death. Subsequent follow-up (minimum of 3 months) was done during their visits to outpatient clinics or through telephone.

Technical success was defined as complete nonvisualization of the bleeding source on angiography at the end of the embolization procedure. Clinical success was defined as the resolution of bleeding without recurrence within 30 days after embolization.[15,16] Recurrence of bleeding was divided

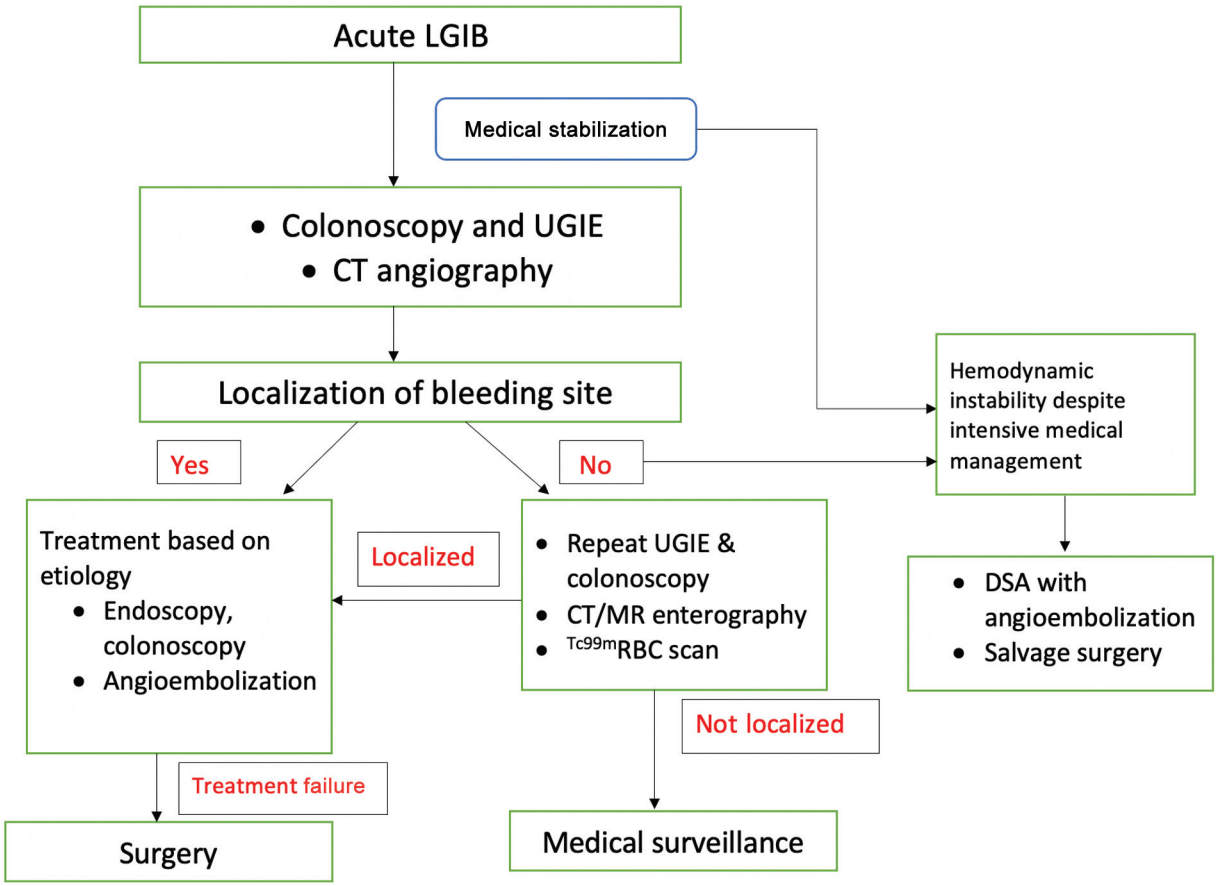

Fig. 1 Flowchart of the management protocol for patients with acute lower gastrointestinal bleed (LGIB) practiced at our institute. CT, computed tomography; DSA, digital subtraction angiography; MRI, magnetic resonance imaging; RBC, red blood cell; UGIE, upper gastrointestinal endoscopy.

Fig. 2 A 37-year-old male patient with acute necrotizing pancreatitis presenting with hematochezia and blood in the drainage catheter. (**A**) Digital subtraction angiography (DSA) image showing left colic artery pseudoaneurysm (*arrow*). (**B**) DSA after embolization with an 18–3-3 microcoil (*arrowhead*) showing nonopacification of the pseudoaneurysm.

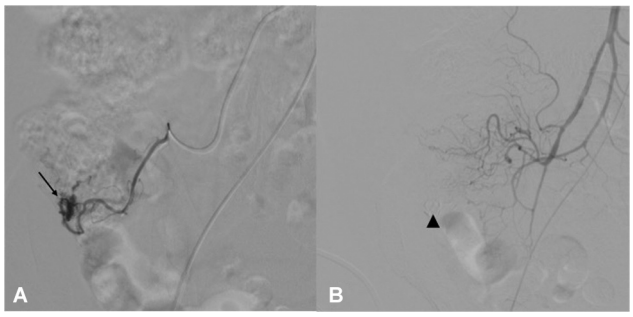

Fig. 3 A 68-year-old male patient presenting with hematochezia. (**A**) Pre-embolization digital subtraction angiography (DSA) showing angiodysplasia (*black arrow*) of the right colon with supply from the ileocolic artery. (**B**) DSA after embolization with 0.2 mL of 30% glue–lipiodol mixture showing the glue cast (*arrowhead*) at the site of angiodysplasia.

into early (within 30 days of embolization) and late (occurring after 30 days).[12] The complications of the embolization were recorded as major and minor according to the Society of Interventional Radiology Standards of Practice Committee guidelines.[17] Minor complications did not require any additional therapy or required nominal therapy in the form of overnight observation without any consequence. Complications that required therapeutic interventions and caused prolonged hospital admission, permanent disability, or death were categorized as major complications.

The clinical and angiographic details were evaluated and compared with outcome parameters including success rates, complications, recurrence, and mortality. Data were analyzed using SPSS Statistics 22.0 software (IBM, Chicago, Illinois, United States). Patient characteristics were evaluated using descriptive statistics. Fisher's exact test was used to assess the factors determining the clinical and

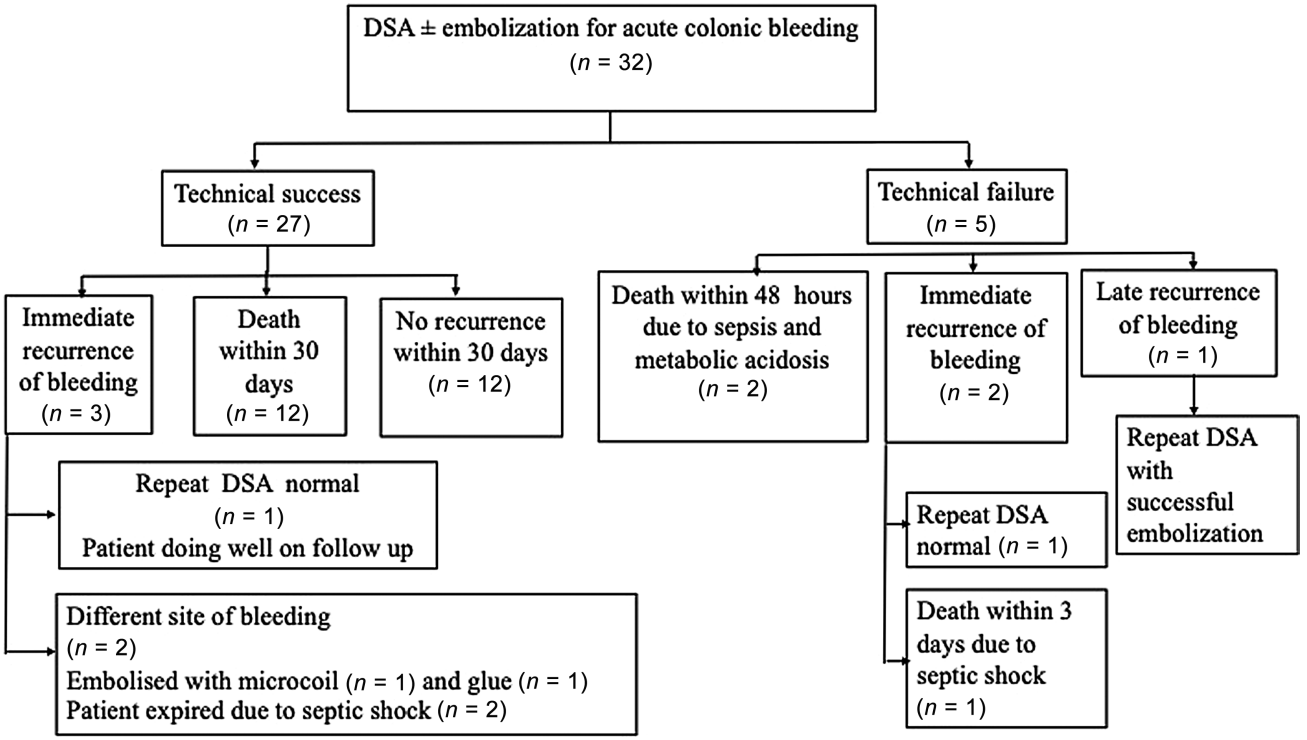

Fig. 4 Flowchart of the study. DSA, digital subtraction angiography.

technical success. The correlation of various clinical and angiographic parameters with outcomes were analyzed by univariate and multivariate logistic regression analyses. The variables were assessed for possible multicollinearity, and those found to be multicollinear were excluded from multivariate analysis even if they were significant in the univariate analysis. A p-value of ≤ 0.05 was considered significant.

Results

A total of 32 patients (mean age: 37.4 ± 15.5 years; 24 males) were included in the study (►**Fig. 4**). The most common etiology was pancreatitis, which was noted in 21 patients (65.6%). The most common clinical presentation was hematochezia, which was observed in all the patients. In addition, bleeding into the drainage catheter placed for collection was seen in 17 patients (53%). Twenty-four patients (75%) had hemodynamic instability due to hemorrhage at the time of presentation. On evaluation, the mean blood hemoglobin level was 6.96 g/dL (range: 3.8–9.8 g/dL) and the majority of the patients ($n = 24$, 75%) had a hemoglobin level below 8 g/dL. Fourteen patients (43.8%) had coagulopathy at presentation, among which four (12.5%) patients had additional thrombocytopenia. The basic demographic and clinical details of the patients are presented in ►**Table 1**.

Preprocedure CT angiography was performed in 23 (71.9%) patients (8 hemodynamically stable patients and 15 patients who were initially hemodynamically unstable at presentation but improved with medical management), of whom 21 (65.6%) showed positive findings and depicted the source of the bleed. The average time lapse between CT angiogram and DSA was 11 ± 13 hours. Colonoscopy was performed before DSA in six (18.8%) patients, which showed multiple colonic ulcers in three (9.4%) patients, active colonic bleeding in two (6.3%) patients, and stricture of ileocecal valve and ascending colon in one (3.1%) patient. In all these patients, colonoscopy could not control the bleeding and the patients were referred for embolization.

The DSA and embolization details are shown in ►**Table 2**. The most common artery involved was the left colic artery ($n = 11$, 34.4%). Microcoils were the most common embolic agent used ($n = 12$, 37.5%).

Technical and Clinical Success

The procedure was technically successful in 27 patients, with a technical success rate of 84.4%. In the remaining five patients, embolization failed due to the inability to catheterize the feeding artery (3 small tortuous arteries and 2 arterial dissection). The arterial dissection occurred at the distal feeding artery level in both the patients. The postdissection run did not show opacification of the feeding artery or the pseudoaneurysm/contrast extravasation. The first patient presented with early recurrence of bleeding after 5 days and a repeat DSA was performed, which was normal. No further bleeding occurred during the follow-up. The second patient died within 2 days of embolization due to septic shock and multiorgan dysfunction syndrome and could not undergo repeat DSA. Out of the three patients with small tortuous arteries, one patient had a colonic arteriovenous malformation (AVM) and presented with late recurrence of

Table 1 Demographic, clinical, and angiographic details of the study group

Gender	Male	24 (75%)
	Female	8 (25%)
Age (y), mean (range)		37.5 (18–72)
Hemodynamic status (*n*)	Stable	8 (25%)
	Unstable	24 (75%)
Blood hemoglobin at presentation (g/dL), mean (range)		6.96 (3.8–9.8)
Blood transfusion (median in units), median (range)		4 (1–6)
Coagulation status at presentation (*n*)	Normal	18 (56.2%)
	Abnormal	14 (43.7%)
CT angiogram finding (*n*)	Arterial extravasation	11 (34.3%)
	Pseudoaneurysm	9 (28%)
	Abnormal blush	1 (3%)
	Negative	2 (6.25%)
	Not performed	9 (28.1%)
Colonoscopy (pre-embolization), *n*		6 (22.2%)
Etiology of colonic bleed (*n*)	Acute pancreatitis	20 (62.5%)
	Chronic pancreatitis	1 (3.1%)
	Colonic AVM	2 (6.3%)
	Colitis	2 (6.3%)
	Rectal hemangioma	1 (3.1%)
	Colonic stricture post dilatation	1 (3.1%)
	Post Whipple's surgery	1 (3.1%)
	Colonic angiodysplasia	1 (3.1%)
	Post appendicectomy	1 (3.1%)
	Colonic perforation	1 (3.1%)
	Ileocecal Tuberculosis	1 (3.1%)
Presenting clinical symptoms (*n*)	Bleeding in drainage catheter with hematochezia	17 (53.1%)
	Hematochezia alone	15 (46.9%)

bleeding (after 76 days). Repeat DSA was performed subsequently, and the AVM was successfully embolized with NBCA glue. The remaining two patients had septic shock and metabolic acidosis at presentation and died due to the underlying disease process after a mean time period of 41 ± 35 hours after DSA without any rebleeding.

Among the technically successful group, immediate recurrence of bleeding was observed in three patients (3/27; 11.1%) after 4 ± 1.7 days after initial embolization. All three patients underwent repeat DSA. Two patients had bleeding arising from a site different from the previously embolized one. Of these, one patient had extravasation from the gastroduodenal artery, which was embolized with glue, and the other patient had small pseudoaneurysms arising from the middle colic, jejunal, and ileal branches, all of which were embolized with coils. The third patient had normal DSA, and no recurrence of bleeding was observed during follow-up. Thus, primary embolization was clinically successful in 24 patients with a clinical success rate of 75% (24/32).

Complications and Mortality

Major complications were seen in five patients (15.6%), of whom three had arterial dissection (two failed and one technically successful) during the procedure and the remaining two had microcatheter impaction and fracture (►**Fig. 5**). There was no procedure-related mortality.

Death occurred in 16 patients (50%) within 1 month of the procedure. Of these, 14 patients had acute necrotizing pancreatitis with infected pancreatic necrosis. The cause of death was septic shock and multiorgan dysfunction syndrome in all the patients. None died due to hemorrhagic shock.

Follow-Up

The mean duration of follow-up of patients who were discharged after DSA ($n = 16$) was 32.5 ± 22.7 months. None of the patients had any complaints related to the embolization procedure. No clinically evident ischemic or obstructive symptoms of the colon were seen.

Table 2 Angiographic findings and embolization details of the patients

Angiographic findings (*n*)	Pseudoaneurysm	16 (50%)
	Extravasation	8 (32%)
	Mucosal staining	5 (15.6%)
	Arteriovenous malformation	2 (6.2%)
	Tumor blush	1 (3.1%)
Embolic material used (*n*)	Microcoil	12 (44.4%)[a]
	Glue	8 (29.7%)[a]
	Gelfoam	4 (14.81%)[a]
	Polyvinyl alcohol particles	2 (7.4%)[a]
	Coil plus glue	1 (3.7%)[a]
Arterial territory (*n*)	Left colic artery	11 (34.4%)
	Middle colic artery	8 (25%)
	Right colic artery	7 (21.9%)
	Ileocolic artery	4 (12.5%)
	Superior rectal artery	2 (6.25%)
Number of feeding arteries embolized (*n*)	One	23 (85.2%)
	Two	3 (11.1)
	Three	1 (3.7%)

[a]Percentage calculated from 27 technically successful cases of angioembolization.

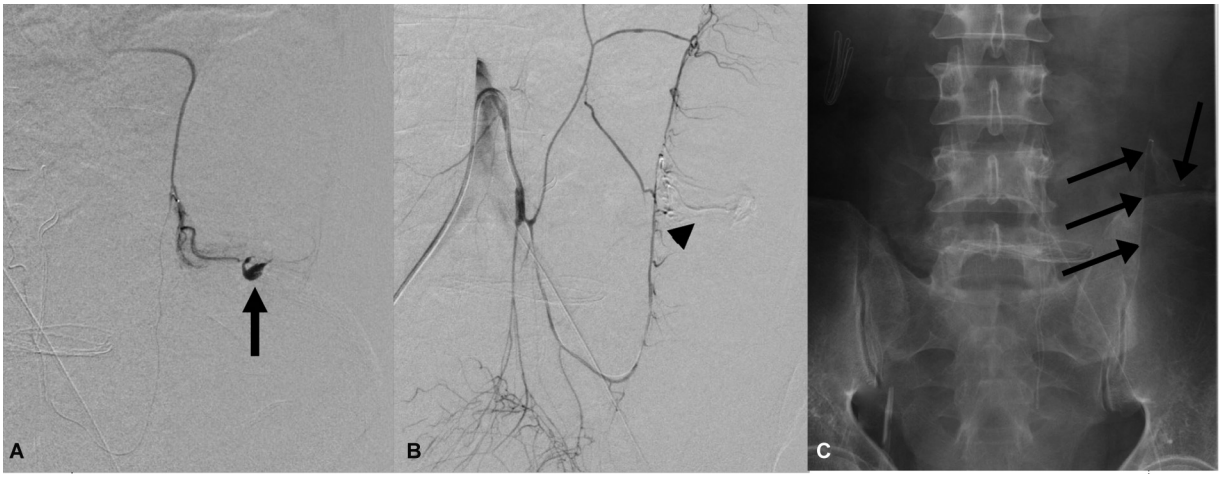

Fig. 5 A 40-year-old male patient presenting with hematochezia 18 days after exploratory laparotomy for gastric perforation. (**A**) Digital subtraction angiography (DSA) image showing active contrast extravasation from the left colic artery (*thick arrow*). (**B**) DSA after embolization with 0.1 mL of 50% glue–lipiodol mixture showing occlusion of the bleeding artery (*arrowhead*). (**C**) Spot radiograph image showing a 16-cm microcatheter fragment (*thick arrows*) left in situ within the left colic artery after it fractured following glue embolization.

Correlation of Outcomes with Clinical and Angiographic Parameters

The technical and clinical success rates, complications, and recurrence of symptoms did not show any significant correlation with clinical parameters such as gender, etiology of bleeding, hemoglobin level at presentation, coagulation status of the patient, and hemodynamic status at presentation ($p > 0.05$; ►**Table 3**). Further, there was no significant difference in the technical and clinical success rates, mortality, complication, and recurrence rates between different arterial sites of embolization ($p > 0.05$). There was no significant difference in any of the outcomes between the use of coil and glue as embolizing agents ($p > 0.05$). The correlation of outcomes with clinical and angiographic parameters is provided in ►**Table 3**.

The mortality after embolization showed significant association with the etiology of bleeding ($p = 0.023$) and hemodynamic status at presentation (0.037) on univariate analysis. However, on multivariate analysis only the etiology of bleeding was statistically significant with an odds ratio of 8.06 (►**Table 4**). The hemodynamic status of the patients at presentation could not be adjusted in the multivariate analysis

Table 3 Correlation of outcomes with clinical and angiographic parameters

Clinical parameters	Technical success		Clinical success		Complications		Mortality		Recurrence	
	n (%)	*p*-value	*n* (%)	*p*-value	*n* (%)	p-value	*n* (%)	*p*-value	*n* (%)	*p*-value
Gender										
Male ($n=24$)	20 (83.3)	1	18 (75)	1	4 (16.6)	1	10 (41.6)	0.22	5 (20.8)	1
Female ($n=8$)	7 (87.5)		6 (75)		1 (12.5)		6 (75)		1 (12.5)	
Coagulation										
Normal ($n=18$)	13 (92.8)	0.36	13 (72.2)	1	3 (16.6)	1	7 ((38.8)	0.28	4 (22.2)	0.67
Abnormal ($n=14$)	14 (77.8)		11 (78.5)		2 (14.2)		9 (64.2)		2 (14.2)	
Etiology										
Pancreatitis ($n=21$)	18 (85.7)	1	15 (71.4)	0.68	2 (9.5)	0.31	14 (66.6)	0.02	4 (19)	1
Others ($n=11$)	9 (81.8)		9 (81.8)		3 (27.2)		2 (18)		2 (18.1)	
Blood Hb										
<8 g/dL ($n=24$)	21 (87.5)	0.58	18 (75)	1	5 (20.8)	0.30	13 (54.1)	0.68	5 (12.5)	1
>8 g/dL ($n=8$)	6 (75)		6 (75)		0 (0)		3 (16.6)		1 (20.8)	
Hemodynamic status										
Stable ($n=8$)	5 (62.5)	0.08	5 (62.5)	0.38	3 (37.5)	0.08	1 (12.5)	0.03	2 (25)	0.62
Unstable ($n=24$)	22 (91.6)		19 (79.2)		2 (8.3)		15 (62.5)		4 (16.6)	
Embolic used										
Microcoil ($n=12$)	12 (100)	-	10 (83.3)	0.50	0 (0)	0.14	8 (66.6)	0.64	2 (16.6)	0.49
Glue ($n=8$)	8 (100)		8 (100)		2 (25)		4 (50%)		0 (0)	
Arterial territory										
Right colic artery ($n=7$)	6 (85.7)		6 (85.7)		2 (28.5)		2 (28.5)		1 (14.2)	
Middle colic artery ($n=8$)	6 (75)	0.93	4 (50)	0.37	2 (25)	0.12	4 (50%)	0.34	2 (25)	0.87
Left colic artery ($n=11$)	9 (81.8)		8 (72.7)		0 (0)		8 (72.7)		3 (27.2)	
Ileocolic artery ($n=4$)	4 (100)		4 (100)		0 (0)		1 (25)		0 (0)	
Superior rectal artery ($n=2$)	2 (100)		2 (100)		1 (50)		1 (50)		0 (0)	

due to small numbers. The presence of coagulopathy ($p=0.285$) and lower hemoglobin ($p=0.685$) at presentation showed no statistically significant association with mortality.

Discussion

The present study showed that superselective endovascular embolization of colonic arteries in patients with acute LGIB is safe with a high technical success rate (27/32, 84.4%) and clinical success rate (24/32, 75%). Major complications (5/32, 15.6%) and recurrence rates (6/32, 18.7%) were low and there were no predictable or associated factors. High mortality after embolization was seen due to the high incidence of septic shock in patients with acute necrotizing pancreatitis. No death occurred due to hemorrhagic shock. None had long-term sequelae due to embolization of colonic arteries.

The clinical success rates of superselective embolization for acute colonic bleeding in the present study were similar to the studies published by Bua-Ngam et al[16] and by Gillespie et al[18] in which the success rates were 63 and 76%, respectively. The technical success rate in our study was lower than the 92 and 93% success rates reported in the above-mentioned two studies. The reasons for technical failure reported in the study by Gillespie et al included vascular tortuosity, vasospasm or stenosis, and occasional cessation of bleeding.[18] Bua-Ngam et al showed that the use of gelatin sponge (in 27/38, 71%), which is a temporary embolizing agent, was the reason for the lower clinical success rate in their study.[16]

Table 4 Univariate and multivariate analyses of clinical parameters with mortality

Parameters	Mortality		
	Univariate analysis	Multivariate analysis	
	p-value	Odds ratio	*p*-value
Coagulation	0.285	0.62 (0.12–3.26)	0.362
Etiology	0.023	8.06 (1.13–57.2)	0.037[a]
Blood hemoglobin level at presentation	0.685	0.85 (0.11–6.33)	0.352

[a]Significant at *p*-value.

In the present study, permanent embolics were used in a majority (23/27; 85.2%) of the patients, which could explain the higher clinical success rates.

Microcoils were the most common embolic agent (12/27; 44.4%) used in the current study. Hur et al used NBCA glue in 84/112 (75%) patients in their study.[12] They observed several advantages of using glue in LGIB, including its ability to be delivered more distally from the microcatheter tip due to its liquid nature and its capacity to polymerize and occlude a vessel with certainty even in the setting of coagulopathy. Kuo et al advocated microcoils as the embolic material due to its radio-opaque nature, high accuracy of deployment, lack of reflux, and ability to decrease perfusion pressure while allowing enough collateral flow, thus reducing the risk of infarction.[19] Yonemitsu et al showed that embolization with microcoils and glue was more effective and feasible than with gelatin sponge particles in terms of hemostasis and prevention of recurrent hemorrhage in patients with deranged coagulation profiles.[20] In the present study, out of the three patients who had early recurrence after embolization, microcoils were used in two patients and Gelfoam in one patient, with success rates of 83.3% (10/12) and 75% (3/4), respectively.

In our study, no clinical or embolization procedure–related variables were found to be associated with technical and clinical failure. Researchers have reported that hypovolemic shock, coagulopathy, and hemoglobin less than 8 g/dL were associated with failure of embolization in acute gastrointestinal hemorrhage.[21,22] Although the literature shows the incidence of bowel ischemia to be in the range of 0 to 5% following transarterial embolization for LGIB, none of the patients developed this complication in the current study.[12–14]

The in-hospital mortality for LGIB after embolization as reported in prior studies ranged from 25.0 to 55.6%.[23–25] The causes for this included respiratory failure, sepsis, upper gastrointestinal bleeding, brain death after multiple traumas, cardiac failure, and recurrent bleeding.[25] Bua-Ngam et al[16] reported that in a majority of cases of in-hospital mortality after the technical success of transarterial embolization (8/10 patients), the cause was worsening of the underlying disease rather than ongoing LGIB. Despite a successful embolization, half of the patients ($n = 16$) in the current study died in the hospital as a result of septic shock and multiorgan failure, most ($n = 14$) developing due to acute necrotizing pancreatitis. None died due to hemorrhagic shock, although hemorrhage may have aggravated the risk.

Our study had a few limitations. This was a retrospective study with a relatively small number of cases. There was a selection bias because the study included only those patients who underwent DSA. Hence, the actual incidence of acute LGIB and those who were managed conservatively could not be evaluated. Our institute, being a tertiary referral center, had many patients with severe acute pancreatitis in the study, which may have confounded the outcomes. Colonoscopy or surgery was not done in any of the patients (post-angioembolization). Hence, the incidence of ischemia, which could be asymptomatic, could not be truly assessed. The choice of embolic agents depended on the operator's preference and availability, which might have influenced the results. Adjustment for hemodynamic status was not possible in the multivariate analysis due to the small sample size.

Conclusion

Transarterial embolization is a safe and effective treatment for acute colonic LGIB. The success rates, complications, and recurrence were independent of clinical and angiographic variables. Acute necrotizing pancreatitis was found to be a significant risk factor for mortality despite successful embolization in our study.

Ethical Approval

Ethical approval was obtained from our institute's ethics committee board and the requirement for informed consent was waived. Care has been taken not to disclose the patient's identity directly or indirectly in any form.

Funding

None.

Conflict of Interest

None declared.

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