TREATMENT OF ACUTE LOWER GASTROINTESTINAL HEMORRHAGE BY SUPERSELECTIVE TRANSCATHETER EMBOLIZATION

Rahul Sheth, Vimal Someshwar, Gireesh Warawdekar
Lilavati Hospital, Sir H N Hospital and Wockhardt Hospital, Mumbai

Aim: To evaluate the technical feasibility, success of hemostasis, and complications of transcatheter embolization in the treatment of acute lower gastrointestinal (GI) bleeding. Methods: Retrospective review of 63 patients with acute lower GI bleed who had undergone transcatheter selective embolization of mesenteric arteries over a two-year period. Embolization was carried out only if the arteria recta leading to the bleed could be successfully catheterized (n=52). The lesions treated were located in the jejunum (n=13), ileum and ileo-cecal region (n=9), appendicular region (n=2) and colon (n=28). Embolization was performed with only polyvinyl alcohol particles (PVA) (250-500 microns) in 23 patients, only microcoils in 16 patients, and both PVA particles and microcoils in 13 patients. Twenty-eight patients were evaluated for objective evidence of ischemia by colonoscopy (n=21) and/or histologic evidence in the surgical specimen (n=7); 23 patients were followed up clinically. Results: Immediate hemostasis was achieved in 61 of 63 patients; of the remaining 2 patients, one underwent surgery whereas the other died during the procedure. Recurrent bleeding occurred in 9 patients – 6 were managed surgically, and 3 medically. Endoscopic evaluation showed mucosal ischemia in 7 patients but they remained asymptomatic on follow up. Embolization was the sole modality of treatment in 41 patients (78.9%). Conclusion: Transcatheter superselective embolization is an effective and safe modality of treatment for acute lower GI bleeding.

Indian J Gastroenterol 2006;25:290-294

Treatment options for acute lower GI hemorrhage include conservative medical management, endoscopic coagulation, transcatheter embolization and surgery. Although most bleeding episodes resolve spontaneously with conservative management, 10%-15% of patients require some form of intervention. Endoscopy is often the method of choice for investigation and treatment of lower GI bleeding; however, massive bleeding may preclude precise localization of the site of hemorrhage. Surgery is associated with significant morbidity and mortality.

The two transarterial treatment options available are pharmacologic control using vasopressin infusion and transcatheter embolization. Vasopressin infusion, though associated with high initial control rate, is associated with high re-bleeding rate (20%-50%) on stopping the infusion and a high rate of cardiovascular complications. Superselective catheterization and transcatheter vasopressin infusion avoids the systemic complications of vasopressin and limits the area of intestinal ischemia.

Although percutaneous embolization has been widely used for treatment of upper GI hemorrhage, there have been few studies to determine its efficacy for lower GI bleeding. The main concern has been a poor collateral supply in the lower GI tract. We report a retrospective review of our experience with embolization in patients with lower GI bleed.

Methods

We reviewed the case records of 63 patients (age range 32-81 years [mean 56]) who had undergone an attempt at angiographic embolization for acute lower GI hemorrhage between February 2002 and March 2004. The indications for angiography were life-threatening hemorrhage, with negative colonoscopy and upper GI endoscopy. Embolization was done in only those cases (n=52 [83%]; 28 men) in whom bleeding site could be demonstrated at angiography and the bleeding vessels selectively catheterized. After embolization, the patients were monitored for symptoms, signs or laboratory evidence of intestinal ischemia and for recurrent intestinal hemorrhage.

The patients were followed up for 3-18 months (mean 10). In addition, 28 of 52 patients also underwent investigations to look for ischemia (colonoscopy 17, histological evaluation of tissue 7, or both 4). Colonoscopy was done 7-180 days after the embolization procedure to look for infarcts, submucosal hemorrhage, ulceration (in the early phase) and strictures (in the late phase). Seven patients underwent surgery for persistent (n=1) or recurrent (n=6) bleeding 0-9 days after embolization.

Embolization technique

All patients underwent a diagnostic digital subtraction angiography (DSA) and conventional (non-subtracted) angiography; the latter was done when the
patient could not hold breath adequately, or it was thought that bowel movements would interfere with interpretation of DSA findings. Celiac, superior and inferior mesenteric arteries were selectively catheterized, using either a 5 Fr Renal or Simmons I diagnostic catheter (Cordis, Johnson and Johnson, USA). Embolization was performed only if the bleeding site could be identified (Figs. 1 and 2). Superselective catheterization of the vessel feeding the bleed site was done using a coaxial 0.018”/0.21” microcatheter (Microferret, Cook, USA; Progreat, Terumo, Japan) and a 0.014”/0.021” microwire system (Transend, Boston Scientific; Terumo, Japan). Although in most cases the target vessels were vasa recta supplying the bleeding site, in a few cases (n=3) embolization was done within the marginal artery of Drummond or in the distal intestinal arcades/distal colonic branches. The embolization agents used were polyvinyl alcohol (PVA) particles (250-500 µm in size; Contour, Target Therapeutics, Boston Scientific) (n=23), or 0.018” Microcoils (Cook, USA) (n=16), or both (n=13).

After embolization, a check angiogram was performed. For PVA particles, occlusion of the feeding vessel with stasis of the contrast material in it, and reflux of contrast material into adjacent normal vessels were considered as success. For coils (with or without PVA), total occlusion of the feeding vessel without extravasation of the contrast material beyond the coil was considered as success.

Fig 1: A: Superior mesenteric angiogram shows frank contrast extravasation of contrast material from branch of second jejunal artery. B: Superselective catheterisation of feeder branch done using microcatheter/microwire system; contrast extravasation seen. C: Angiogram post particulate and coil embolization shows cessation of contrast extravasation from bleeding jejunal artery

Fig. 2: A: Inferior mesenteric angiogram shows frank contrast extravasation from left branch of superior rectal artery. B: Superselective embolization done with PVA particles through microcatheter. Post embolization angiogram shows cessation of contrast extravasation from bleeding vessel
Results

The causes and sites of bleeding are listed in the Table. Embolization could not be done in 11 of 63 patients because of failure to localize the bleeding site (n=7), severe vasospasm of the blood vessels not relieved by vasodilators (n=3), or severe angulation of the feeder vessel precluding superselective catheterization (n=1). Among the 52 patients who underwent embolization, 37 had catheterization of the superior mesenteric artery and 15 had that of the inferior mesenteric artery. Superselective catheterization of the superior mesenteric artery involved the distal jejunal artery (n=13), ileal and ileo-colic arteries (9), appendicular artery (2), a branch of the middle colic artery (4), or a branch of the right colic artery (9). Catheterization in the inferior mesenteric artery territory involved a branch of the left colic artery (n=8), a branch of the sigmoid artery (6) or a branch of the superior rectal artery (1). In 41 (79%) patients, embolization was the sole treatment modality.

Immediate hemostasis was achieved in 50 (96%) of the 52 cases. In one patient with failed treatment, the bleeding site was localized to the ileo-cecal junction. In this patient, embolization with PVA particles led to a sluggish blood flow in the feeder arteries but the bleeding persisted; at surgery, multiple ulcers involving the ileo-cecal junction and the cecum were seen, and a resection-anastomosis was done. Histological examination revealed the disease to be tubercular in nature. The other patient with failed treatment had been referred to us with massive bleeding, poor vital signs and a platelet count of 70,000/mL. Angiography revealed bleeding from the sigmoid branch of the inferior mesenteric artery, possibly due to diverticular disease. Embolization was performed with microcoils; however the patient had a massive cardio-respiratory arrest during the procedure, and died despite resuscitative measures.

In 9 patients, the bleeding recurred 1-103 days after successful initial embolization. Three of them were treated conservatively. The other 6 patients underwent surgical treatment; of these, one underwent attempt at repeat angiographic embolization of the feeder artery (a branch of the middle colic artery), which failed because of severe vasospasm unresponsive to intra-arterial nitroglycerine and nikorandil. In two of the 6 patients who underwent surgery, recurrent hemorrhage was at the site of initial embolization, and in 2 patients from a different site. At surgery, 2 patients underwent resection-anastomosis for ileo-cecal tuberculosis of ulcerative variety, 2 underwent resection for diverticular disease of the descending colon, 2 underwent total colectomy for ulcerative colitis, and 1 patient underwent resection-anastomosis for a solitary ulcer in the distal jejunum, probably due to long-term anti-inflammatory drug use. Overall, 7 of the 52 (14%) patients taken up for embolization required surgery for persistent or recurrent hemorrhage.

Of the 52 patients who underwent embolization, one died; of the remaining 51, 28 underwent evaluation for objective signs of ischemia (colonoscopy 17, histology 7, both 4) and 23 were followed up clinically. Signs of post-embolization intestinal ischemia were seen in 7 patients (25%), ischemic infarcts (2), submucosal hemorrhages (4), ulceration (1). These patients remained clinically asymptomatic and did not develop any long-term complications. Mucosal ischemia was seen in all 7 patients, with minimal inflammation.

One patient developed subacute intestinal obstruction after 92 days, in the mid-jejunal region, diagnosed on small bowel enema; this was managed conservatively.

Discussion

angiographic embolization is widely accepted as an effective and safe treatment for upper GI hemorrhage. The presence of a widespread collateral network in the upper GI tract makes embolization a relatively safe procedure.

The first attempts at transcatheter embolization for acute lower GI hemorrhage were reported by Goldberger and Bookstein. In 1982, Rosenkrantz et al. reported colonic embolization in 23 patients, of whom three had bowel necrosis. In initial years, most procedures were done using large catheters. With refinement of the technique and equipment, and a better understanding of the vascular anatomy of the small bowel and the colon, the results of

<table>
<thead>
<tr>
<th>Table: Causes of lower gastrointestinal hemorrhage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site of bleeding</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>Jejunum</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Ileum and ileocolic</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Appendix and colon</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
transcatheter embolization therapy for acute lower GI hemorrhage have improved. Thus, in four studies, superselective embolization was performed in 47 patients with acute lower GI hemorrhage (small bowel 18, colon 29). This was done usually at the level of the marginal artery, distal intestinal arcade, or vasa recta. Although a variety of occlusive agents were used, in 29 patients coils were used alone or in combination. Immediate hemostasis was achieved in 43 patients (91%) and in no case did infarction occur as a direct result of the procedure. Two more recent studies have reported success rates of 76% and 44%, respectively, for transcatheter embolization in the treatment of acute lower GI hemorrhage.

The goal of embolization therapy is to decrease the pulse pressure at the bleeding site to allow for hemostasis. Although the lower GI tract has a paucity of large collaterals, it has rich intramural vascular networks, which may protect against ischemia during distal, selective embolization. Thus, in embolization for lower GI bleed, in order to reduce the area at risk for ischemia, the most distal site should be chosen. The vasa recta or marginal artery seem to be the most plausible sites. This is supported by recent evidence, including ours, which report extremely low complication rates.

A wide variety of embolization agents, including gelfoam, PVA particles, liquid embolization agents and microcoils, have been used. Gelfoam is no longer widely used for lower GI hemorrhage since its effect is temporary and it cannot easily be deployed in a superselective manner. Similarly, liquid embolic agents such as glue are suboptimal because of difficulty in assessing adequate dilution and in controlling vascular penetration. Guy and Defreyne successfully used PVA particles as the primary embolization agent in the treatment of lower GI hemorrhage, with no evidence of bowel infarction. However, there have been some reports, though inconclusive, that PVA particles may lead to post-embolization ischemia.

The advent of coaxial microcatheters and torqueable microwires has made it possible to reach the bleeding site in nearly all cases, leading to a marked rise in the use of microcoils. These are available in various diameters and lengths. Since the coils are radio-opaque and their delivery can be reasonably controlled, they are the agents of first choice in transcatheter embolization. Funaki et al have shown that microcoils can achieve immediate hemostasis in 96% and long-term clinical success in 81% of patients with colonic bleeding. Kuo et al found superselective microcoil embolization to be a safe and effective technique for acute lower GI hemorrhage, with immediate hemostasis in all their 22 patients, complete clinical success in 86% of patients, and no major ischemic complications.

Transcatheter therapy cannot be done in the presence of vasospasm and unfavorable vascular anatomy. In addition, operator skill and experience also play a role.

In conclusion, superselective transcatheter embolization using PVA particles or microcoils is an effective and safe modality for the treatment of acute lower GI hemorrhage. This treatment is not associated with significant clinical ischemia or infarction, and should be used in patients with failure of conservative management.

References
12. Ledermann HP, Schoch E, Jost R, Decurtins M, Zollikoffer CL. Superselective coil embolization in acute gastrointestinal hemorrhage: personal experience in 10 patients and review

**Correspondence to:** Dr Sheth, 10 Krishna Kunj, 29/30 K M Munshi Marg, Chowpatty, Mumbai 400 007. E-mail: rahulsheth7@hotmail.com

Received May 24, 2006. Received in final revised form September 4, 2006. Accepted November 4, 2006