

## New Technique of Embolization of the Hemorrhoidal Arteries Using Embolization Particles Alone: Retrospective Results in 33 Patients

### Abstract

**Purpose:** The purpose of this study was to assess the safety and efficacy of using particles only in the embolization of the hemorrhoidal arteries for the management of hemorrhoids. **Subjects and Methods:** This is a retrospective study for patients treated between March 2015 and December 2018. We treated 33 patients, 13 men and 20 women with a mean age of 37 years (range: 18–70 years), in which 11 patients had Grade II hemorrhoids and 22 had Grade III hemorrhoids. Technical and clinical successes together with procedural complications were assessed. **Results:** The technical success rate was 100%. No minor or major complications have been reported. No cases of anorectal ischemia, anal incontinence, hemorrhoidal thrombosis, or complications related to femoral arterial puncture have occurred. Follow-up was at 3 months and 12 months postembolization. Clinical success was observed in 32 patients (96.9%) with improvement by at least 2 points of the French bleeding score at 3 months postembolization. **Conclusion:** The use of particles alone in the embolization of hemorrhoidal arteries whether from the superior rectal artery and/or from the middle and inferior rectal arteries can offer a safe and effective treatment option.

**Keywords:** Bleeding, embolization, hemorrhoids, particles

### Introduction

Hemorrhoidal disease is the most common anorectal pathology with a prevalence of 5%–40%.<sup>[1]</sup>

Chronic bleeding is one of the main symptoms in patients with an internal hemorrhoidal disease which may or may not be associated with hemorrhoidal prolapse.<sup>[1]</sup> Vidal *et al.* suggested a hemorrhoidal artery embolization technique<sup>[2]</sup> as an alternative to surgery. This technique was suggested by endovascular occlusion of the distal branches of the superior rectal artery (SRA) by microcoils. This technique showed a technical and clinical success with good short-term results in patients suffering from chronic bleeding with or without contraindications for surgery.<sup>[3]</sup> Combining polyvinyl alcohol particles with coils in the embolization of hemorrhoids has shown high clinical success and is presumed to increase clinical effectiveness without leading to anorectal ischemia despite distal embolization at the level of the hemorrhoidal plexus.<sup>[4]</sup>

This study aims at describing the efficacy of using particles only in the embolization

of the hemorrhoidal arteries for treating the hemorrhoids.

### Subjects and Methods

After obtaining approval from our institutional review board, a retrospective study for patients treated between March 2015 and December 2018 was done.

A total of 33 patients were included (13 men and 20 women), with a mean age of 37 years (range, 18–70 years): eleven patients with Grade II hemorrhoids and 22 patients with Grade III hemorrhoids according to the Goligher Internal Hemorrhoid Classification [Table 1].

All embolization procedures were done by the same interventional radiologist with a 13-year experience (KA) in four different institutions. Access was obtained through the right common femoral approach under local anesthesia.

Catheterization of the inferior mesenteric artery (IMA) and both internal iliac arteries (IIAs) was done in all cases using 5-Fr C2 Cobra Catheter (Boston Scientific, USA) and 2.7-Fr microcatheter (Progreat Microcatheter System, Terumo, Japan).

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Embolization was done by 2-ml vials of 300–500 µm tri-acryl gelatin microspheres (Embosphere®, Merit Medical Systems, Inc., USA). Each 2-ml syringe of embospheres was diluted with a 20-cc syringe containing a mixture of contrast material, saline, 1 cm of 0.1% lidocaine, and 1 ampoule of a broad-spectrum antibiotic (80 mg/2 ml Gentamicin, Epigent, Egypt).

### Technical success

Immediate technical success was defined as the ability to embolize the branches supplying the hemorrhoidal cushions mainly from the SRA with or without middle or inferior rectal arteries with cessation of blood flow in the hemorrhoidal arteries (below symphysis pubis).

### Follow-up

Patients were followed by the interventional radiologist at 3 months and 1 year postembolization, to assess changes in bleeding symptoms (using French bleeding score<sup>[3]</sup> and by assessment of hemoglobin levels). A follow-up of complications was also assessed.

Primary clinical success was defined as improvements in clinical scores (by at least 2 points for the French bleeding score and a rise in the postembolization hemoglobin levels) 3 months postembolization, with no complications.

A comparison of pre- and 3 months posttreatment hemoglobin levels was performed using the sign test. Statistical analyses were conducted using Primer software version 7 (PRIMER-e, Auckland, New Zealand). Data were expressed as mean ± standard deviation, and  $P < 0.05$  was considered statistically significant.

The secondary clinical success includes a decrease or disappearance of the anal pain and other related symptoms as Pruritus and itching 3 months postembolization.

## Results

Immediate technical success was seen in all cases.

Angiographic images of the patients revealed that hemorrhoidal arterial supply was seen from SRA arising from IMA alone in 22/33 patients (66.7%), whereas it was seen to be from SRA and middle rectal artery (MRA) arising from the anterior division of IIA in 9/33 patients (27.3%). In 2/33 patients (6%), it was from SRA and both MRAs [Table 2].

The inferior rectal artery arising from the internal pudendal artery was identified in 5 patients supplying the hemorrhoids yet was not embolized due to its smaller caliber and the fact that particle embolization provides more distal embolization overcoming inadequate embolization.

No minor or major complications were reported in the early postoperative period based on the Society of Interventional Radiology classifications. No cases of anorectal ischemia, anal incontinence, hemorrhoidal

thrombosis, or complications related to femoral arterial puncture have occurred. Postembolization anal pain was reported in 27/33 (81%), which was self-limiting and lasted for few days posttreatment.

All patients could be followed up to 3 months after embolization. Unfortunately, 17 patients (51%) were lost to follow-up at 1 year.

Clinical success was observed in 32 patients (96.9%) with improvement by at least 2 points of the French bleeding score<sup>[3]</sup> at 3 months postembolization. Twenty-seven patients (81.8%) experienced complete resolution of rectal bleeding, whereas 15.2% of patients (5 cases) had reported a marked decrease in bleeding rates with no complete resolution of rectal bleeding [Table 3].

Marked improvement of anal pruritis, pain, and itching was reported in 30/33 patients (90.9%) at 3 months postembolization [Table 3].

**Table 1: Goligher Internal Hemorrhoid Classification**

Grade	Degree of Protrusion
Grade I	No protrusion
Grade II	Protrusion with spontaneous reduction
Grade III	Protrusion requiring manual reduction
Grade IV	Protrusion that cannot be reduced

**Table 2: Angiographic findings (arterial supply of hemorrhoids)**

Arterial Supply of Hemorrhoids	No. of patients (%)
SRA	22 (66.7)
SRA + one MRA	5 (15.1)
SRA + both MRAs	1 (3)
SRA + one MRA + one IRA	4 (12.1)
SRA + both MRAs + one IRA	1 (3)
Total	33

SRA: Superior rectal artery, MRA: Middle rectal artery, IRA: Inferior rectal artery

**Table 3: Symptoms relief 3 months postembolization**

Symptoms	No. of patients (%)
Bleeding	
Complete bleeding resolution	27/33 (81.8)
SRA only embolization	19/27 (70.3)
SRA + unilateral MRA embolization	7/27 (25.9)
SRA + bilateral MRA embolization	1/27 (3.7)
Partial hemostasis	5/33 (15.2)
SRA only embolization	2/5 (40)
SRA + unilateral MRA embolization	2/5 (40)
SRA + bilateral MRA embolization	1/5 (20)
No hemostasis (SRA only embolization)	1/33 (3)
Pain/itching/pruritis	
Marked improvement	30/33 (90.9)
Minimal improvement	3/33 (9.1)
No improvement	0 (0)

SRA: Superior rectal artery, MRA: Middle rectal artery, IRA: Inferior rectal artery

In only one case, bleeding rate did not change despite adequate embolization of the hemorrhoidal arteries and was attributed mostly to preexisting undiagnosed ischemic colitis disease; this was in a 70-year-old patient as preprocedural colonoscopy revealed apart from internal hemorrhoids Grade II, edema, and submucosal hemorrhage and erosions (signs of ischemic colitis), so it was assumed that ischemic colitis was the cause of bleeding rather than the hemorrhoids.

Follow-up of hemoglobin levels revealed improvement of its levels at 3 months and 1 year after embolization. While preprocedural hemoglobin concentration ranged from 4.5 to 10 g/dl, with a mean of 8.2 g/dl, it showed improvement after 3 months to mean 9.5 g/dl in all patients [Table 4].

Sixteen patients could be followed up to 1 year after the procedure revealing mean hemoglobin level of 11 g/dl.

### Discussion

Embolization treatment was considered after the recognition of the vascular nature of hemorrhoids<sup>[2,3]</sup> where researches indicated that bleeding from the hemorrhoids is mainly arterial in nature.<sup>[5]</sup> Transmural branches of the SRA play a crucial role in the arterial blood supply of the hemorrhoids together with the middle<sup>[6]</sup> and/or inferior rectal arteries.<sup>[7]</sup>

Previous studies showed the effectiveness of using coils only in the embolization of SRA with a 93%–100% technical success rate and a 72% clinical success rate.<sup>[3,4,8]</sup> Other studies used a combination between coils and particles in the embolization process with a 83%–94% clinical success rate.<sup>[4]</sup>

The technique we describe entails the embolization of not only the SRA but also catheterization of the IIA and embolization of MRAs if they were proven to supply the hemorrhoidal cushions by diagnostic angiography [Figure 1-3].

This technique achieved a 100% technical success rate and a 96.9% clinical success rate. Our results are also comparable to the surgical techniques for hemorrhoids with the advantage of much less complication rates.<sup>[9-14]</sup> Milligan *et al.*'s open hemorrhoidectomy is the reference surgical

technique.<sup>[15]</sup> New surgical techniques aimed to decrease pain as well as cost of the procedure and to allow the rapid return of patients to their social and professional activities. In 1995, Longo introduced a new technique of circular-stapled anopexy for treating hemorrhoids.<sup>[16]</sup> It showed a decrease in the surgery time and in the meantime of hospitalization as well as a decrease in the postoperative pain.<sup>[17-19]</sup> However, it showed higher recurrence rates exceeding 10%.<sup>[18-20]</sup> Complication rates following Milligan and Morgan's or Longo operations were estimated to be 15%–20%.<sup>[9,21,22]</sup> Complications include hemorrhage (4%–17%), acute urine retention (0.3%–22%) stenosis (0.8%–20%), fissures, anal incontinence, fecaloma, exudation, delayed healing, and abscess.

Circular-stapled anopexy was associated with rare but severe complications including rectal perforation, rectal stenosis, retro-pneumoperitoneum, retroperitoneal sepsis, rectovaginal fistula, and sepsis.<sup>[23]</sup> Minimally invasive surgeries have several advantages over the open surgical techniques due to the preservation of the anal sphincter and associated with lower complications rate and faster recovery.<sup>[10]</sup> Minimally invasive surgical techniques include Doppler-guided hemorrhoidal artery ligation (DG-HAL) procedure. This technique entails the same principle of embolization by ligation of the terminal branches of SRA

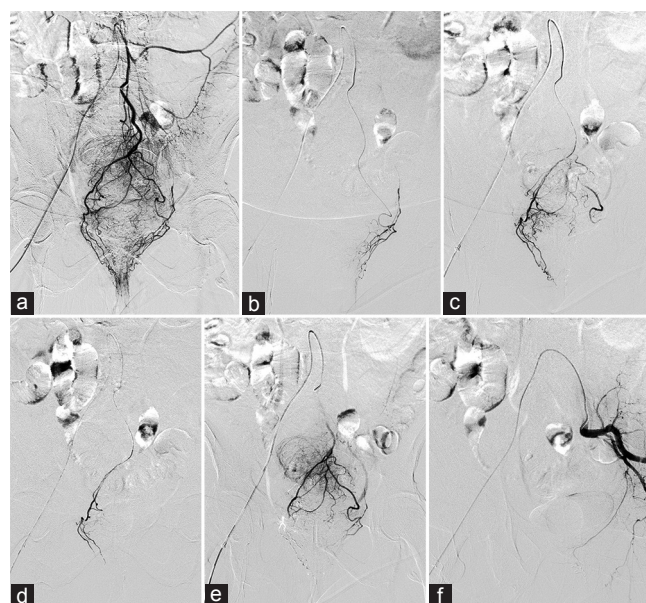
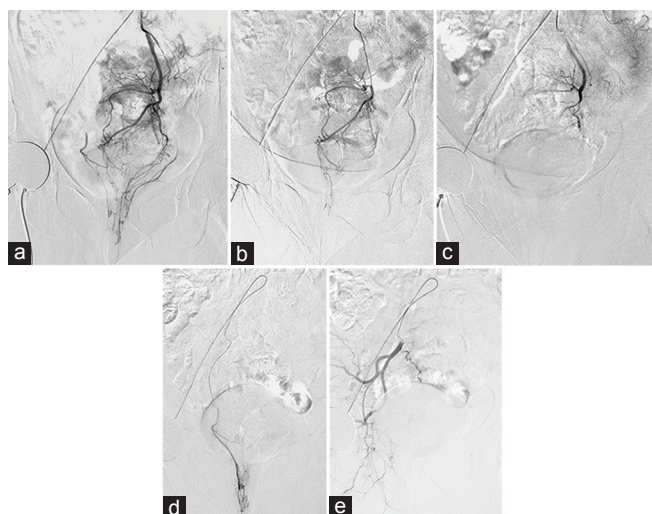


Figure 1: (a) A 25-year-old female presented with bleeding per rectum diagnosed with internal hemorrhoids on endoscopy. Distal superior rectal artery angiogram showing bilateral hemorrhoidal arterial supply through the superior rectal artery with left middle rectal artery anastomosis. (b) Super-selective left hemorrhoidal catheterization with obvious middle rectal artery anastomosis on angiogram. (c) Post 300–500-micron microsphere embolization distal superior rectal artery control angiogram with complete cessation of left hemorrhoidal filling. (d) Super-selective catheterization of the right hemorrhoidal branches. (e) Post 300–500-micron microsphere embolization distal superior rectal artery control angiogram with complete cessation of hemorrhoidal filling bilaterally. (f) Left internal iliac angiogram showing middle rectal artery filling yet with adequate embolization of hemorrhoidal bed through the superior rectal artery branches

**Table 4: Changes in hemoglobin level before and 3 months after embolization**

Hemoglobin level follow-up after 3 months: (n=33)		
Preprocedural hemoglobin level (%)	Postprocedural hemoglobin level	Mean increase (%)
4.5 g/dl (1/33, 15.1)	8 g/dl	+77.7
7-8 g/dl (28/33, 72.7), mean=7.5 g/dl	9-11 g/dl, mean=10 g/dl	+25
9-10 g/dl (4/33, 12.1), mean=9.5 g/dl	10-11 g/dl, mean=10.5 g/dl	+9.5

Statistically significant difference between values obtained before and 3 months after embolization ( $P=0.042$ ) using paired sample *t*-test

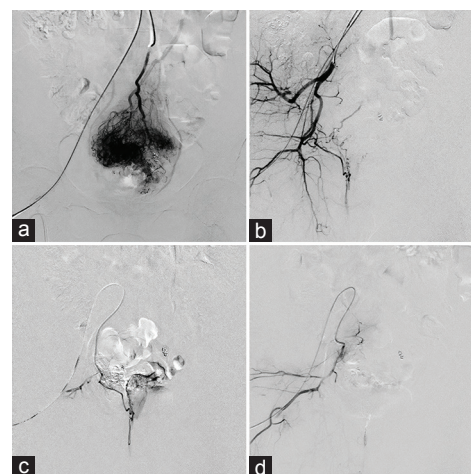


**Figure 2:** (a) A 29-year-old female presented with bleeding per rectum diagnosed with internal hemorrhoids on endoscopy. Distal superior rectal artery angiogram showing bilateral hemorrhoidal arterial supply through the superior rectal artery with bilateral internal iliac anastomosis. (b) Post 300–500-micron microspheres embolization distal superior rectal artery control angiogram with complete cessation of left hemorrhoidal filling. (c) Post 300–500-micron microspheres embolization distal superior rectal artery control angiogram with complete cessation of hemorrhoidal filling bilaterally. (d) Super-selective catheterization of the right middle rectal artery showing hemorrhoidal filling despite adequate embolization through the superior rectal artery. (e) Internal iliac control angiogram showing complete embolization of hemorrhoids

which reduces the blood supply to the hemorrhoidal tissue. It showed a short-term efficacy of 90% and a long-term efficacy of 70%–92%.<sup>[23,11-14]</sup> Postoperative pain occurred in 1%–6% of patients. The complication rate was 2%–12% including hemorrhage 4.3%, hemorrhoidal thrombosis 1.8%, fissures 0.8%, and acute urine retention 0.7%. Embolization compared to DG-HAL offers better visualization of all branches supplying the hemorrhoids, which is not feasible in DG-HAL and accounts for recurrence due to inability to detect all branches in some cases.

The embolization of SRA by coils only was associated with a 28% rate of recurrence.<sup>[2]</sup> This was related to the collateral supply of the corpus cavernosum recti from the recti and was related also to insignificant dominance of the MRA. MRA is not constant, yet it may be present in 25%–40% of patients.<sup>[24]</sup> Anastomoses between the MRA and the SRA can be located below the symphysis pubis, and this was also related to the recurrence because SRA branches are embolized above the level of the symphysis pubis.<sup>[4]</sup> Another explanation for the failure of treatment was related to the presence of unrecognized anatomical variants and coil recanalization.<sup>[3]</sup>

Our technique entails embolization by particles which involve more distal embolization to minimize the risk of recurrence. Other studies justified the embolization of only the SRA by avoiding bowel ischemia; however, in our study, ischemia did not occur. This also is supported by other studies that showed that the embolization of SRA and MRA did not cause ischemia.<sup>[4]</sup>



**Figure 3:** (a) A 55-year-old female with previous coil embolization of proximal hemorrhoidal arteries through the superior rectal artery. Distal superior rectal artery angiogram showing coils in place with no hemorrhoidal supply. (b) Right internal iliac angiogram showing middle rectal artery supply to the hemorrhoids. (c) Super-selective catheterization of the middle rectal artery. (d) Post 300–500-micron microspheres embolization showing complete cessation of hemorrhoidal filling

Another possible advantage in using particles is that the adequate embolization of SRA can be enough with no need to embolize other feeders from middle or inferior rectal arteries, if present, as the particles usually reach deep into the vascular bed of the hemorrhoids with possible achievement of complete bleeding resolution.

This study has several limitations. First, it is a retrospective study with small sample size. Second, the follow-up period was short which limited the conclusions about some predictive factors of recurrence; however, the published data have demonstrated that most recurrences after invasive or minimally invasive surgeries occur before 1 year.<sup>[25]</sup> Third, the study is not controlled which precludes a direct comparison of clinical success rates with other techniques. Finally, the cases were done by a single operator.

## Conclusion

The proposed technique of using particles alone in embolization of supplying arteries to the hemorrhoids, whether from SRA and/or from middle and inferior rectal arteries, may offer an effective and safe treatment option compared to embolization by coils with or without particles.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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