



SHORT ORIGINAL ARTICLE / *Cardiovascular imaging*

# Embolization of the hemorrhoidal arteries (the emborrhoid technique): A new concept and challenge for interventional radiology



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## KEYWORDS

Embolization;  
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artery

**Abstract** Elective transanal Doppler-guided hemorrhoidal artery ligation (DG-HAL) has recently been shown to be effective in hemorrhoidal disease. It consists of ligating the terminal branches of the superior rectal artery under Doppler guidance, in order to reduce the hemorrhoidal arterial blood flow and improve the symptoms. By analogy, we propose performing this arterial occlusion using the “emborrhoid” technique (embolization of the hemorrhoidal arteries), in which arterial occlusion is achieved via the endovascular route using coils placed in the terminal branches of the superior rectal arteries. Three patients have been treated by this new technique, and the observations show that it is feasible and reproducible, with no ischemic complications or pain. Additional studies are needed to evaluate the efficacy of this technique for the treatment of hemorrhoidal disease.

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## Introduction

Hemorrhoidal disease is the most common anorectal condition, with prevalence of 4 to 35%. It mainly presents as a variable amount of rectal bleeding. Its recurrence and the number of hemorrhoids may cause a real alteration in the quality of life, or more rarely, anemia. In the most developed forms, it is accompanied by hemorrhoidal prolapse. Exudation or itching complicate it when there is local maceration. It is usually responsible for local discomfort. Pain is less common, only occurring in the event of a complication (congestive exacerbation, external hemorrhoidal thrombosis, fissures, cryptitis) or where there is an associated condition (pelvic floor disorders, anorectal neuralgia).

*Abbreviations:* Emborrhoid, Embolization of the hemorrhoidal arterial; DG-HAL, Doppler-guided hemorrhoidal artery ligation; SRA, Superior rectal artery.

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Most patients are relieved by medical treatment combining hygiene and dietary measures with phlebotonics, or non-surgical outpatient treatment (infrared photocoagulation, elastic band ligation). Surgical treatment is necessary in 10% of cases [1]. The reference procedure is Milligan and Morgan's open hemorrhoidectomy, first described in London in 1937 [2]. It consists of resecting the three hemorrhoidal cushions by ligating their arterial pedicle as high up as possible. Two less invasive techniques have been proposed. Circular stapled anopexy (Longo procedure) consists of interrupting the terminal branches of the superior rectal arteries and resecting a ring of rectal mucosa [3]. Elective Doppler-guided hemorrhoidal artery ligation (DG-HAL) has been developed with the same objectives [4,5]. By analogy, given the considerable progress in the field of interventional radiology, comparable arterial occlusion could conceivably be obtained with endovascular embolization, by placing coils in the branches of the superior rectal arteries. To date, no study has assessed this technique with the aim of treating a hemorrhoidal condition. On the other hand, several case reports have demonstrated the efficacy of embolization of the superior rectal arteries for treating acute rectal bleeding of various origins [6–11].

Compared with DG-HAL, endovascular embolization has the enormous advantage of identifying all the hemorrhoidal arterial branches perfectly, making it thus possible to completely occlude them with certainty, which could noticeably improve the therapeutic results. In addition, the vascular approach avoids all the anal and rectal traumas which are inevitable with surgical treatment, even if they are minimally invasive; a reduction in morbidity following treatment is thus one of the improvements foreseen.

The aim of this paper is to report three observations evaluating the feasibility and early morbidity of endovascular coil embolization of the superior rectal arteries in treatment of the symptoms of hemorrhoidal conditions: the emborrhoid technique.

## Description of the observations

Three patients with disabling rectal bleeding were treated using the emborrhoid technique. This treatment was decided in a multidisciplinary discussion (proctologist, visceral surgeon and radiologist), given the symptoms of the condition and the patients' surgical histories. The embolizations were performed using a right femoral route after inserting a 5 Fr introducer sheath. The inferior mesenteric artery was catheterized using a Simmons catheter (radifocus angiography catheter - Terumo). The superior rectal arteries were then catheterized with a rapid transit microcatheter (Cordis/Johnson & Johnson, Warren, NJ). The coils used for the embolization were Nester 0.018", 2 and 3 mm in diameter and 3 cm long (Cook, Bloomington, IN).

### Patient no. 1

This was a 43-year-old man, referred for radical treatment of abundant, daily, very disabling, rectal bleeding. This patient had an unexplained hypercoagulation condition discovered after episodes of spontaneous vascular thrombosis (femoral artery and iterative phlebitis) requiring long-term

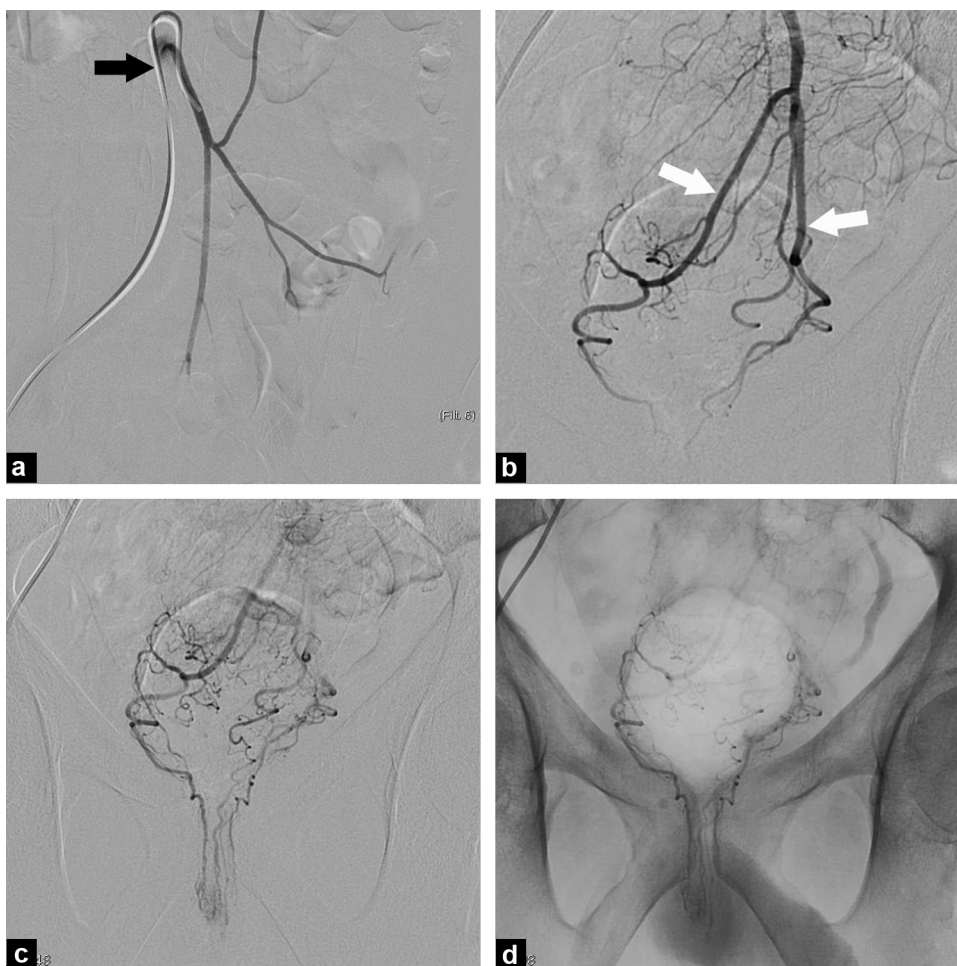
anticoagulant therapy. Ankylosing spondylitis and cluster headaches were also recorded. The endoscopic appearance of the hemorrhoidal plexuses was very unusual, angiomatic, raised into many vascular bunches. Given all these parameters, non-surgical treatment was preferred. The two left and right main superior rectal branches were embolized using Nester microcoils (Figs. 1 and 2). The posterior superior rectal branch was left in place for fear of a potential risk of rectal ischemic complications. For a short time, this treatment reduced the rectal bleeding, which however recurred two weeks later. Another embolization was performed, this time concerning the posterior branch (Fig. 3), causing rectal bleeding to disappear for a month. A third embolization was decided because of recurrence of bleeding. Two arteries which were still patent were identified on the angiographic images; both were embolized (Fig. 4). In the end, all the branches of the superior rectal arteries had been embolized, which resulted in complete cessation of rectal bleeding. Following the last embolization, the patient had a transitory, painful, edematous, perianal reaction. This is a benign reaction, which is already known following DG-HAL. It indicates the efficacy of the arterial occlusion, and is explained by temporary redistribution of blood flow. It regresses spontaneously. Apart from this episode, the patient had no painful or ischemic symptoms. Successive endoscopic examinations showed that the internal hemorrhoids had disappeared. Five months after embolization, the appearance of the rectal mucosa was normal.

### Patient no. 2

A 41-year-old woman had abundant, disabling rectal bleeding due to stage III hemorrhoids. She had undergone surgery in 2008 and 2011 for recurring rectal prolapse treated by a rectopexy to the sacral promontory, performed using a prosthesis fixed to the right anterolateral wall of the lower rectum. Embolization was offered to avoid the risk of intra-operative exposure of the prosthesis. The two left and right main superior rectal branches were embolized using Nester microcoils (Fig. 5). The posterior superior rectal branch was not occluded because of the potential risks of necrosis. The rectal bleeding stopped completely. Clinical examination 3 months after treatment confirmed the disappearance of any vascular turgidity.

### Patient no. 3

This 49-year-old paraplegic man had consulted in 2006 for a rectal mucosal prolapse resulting from sphincter hypotension (flaccid paraplegia). It was very disabling (cutaneous maceration lesions accentuated by the prolonged sitting position, rectal bleeding). Circular stapled anopexy had been performed with excellent results. The symptoms recurred in 2010 and were treated using the same technique. He consulted again in 2013 for recurring rectal bleeding related to turgor of the hemorrhoidal plexuses during endoanal digital maneuvers to provoke defecation. Another circular stapled anopexy was rejected because of the potential risk of localized rectal ischemia due to superimposing areas of stapling. Embolization was proposed. The two left and right main superior rectal branches were embolized using Nester microcoils (Fig. 6). The posterior superior rectal



**Figure 1.** Patient no. 1. First episode of embolization: subtracted and non-subtracted arteriogram of the termination of the inferior mesenteric artery: a: catheterization of the inferior mesenteric artery with a Simmons catheter (white arrow); b: opacification of the proximal superior rectal branches (white arrows); c–d: subtracted and non-subtracted opacification of the distal superior rectal branches. Note the rectal hypervascularization.

branch was not occluded. Rectal bleeding only temporarily disappeared (three weeks), probably due to the incomplete embolization of the superior rectal network. The patient is currently waiting before taking a decision on further embolization.

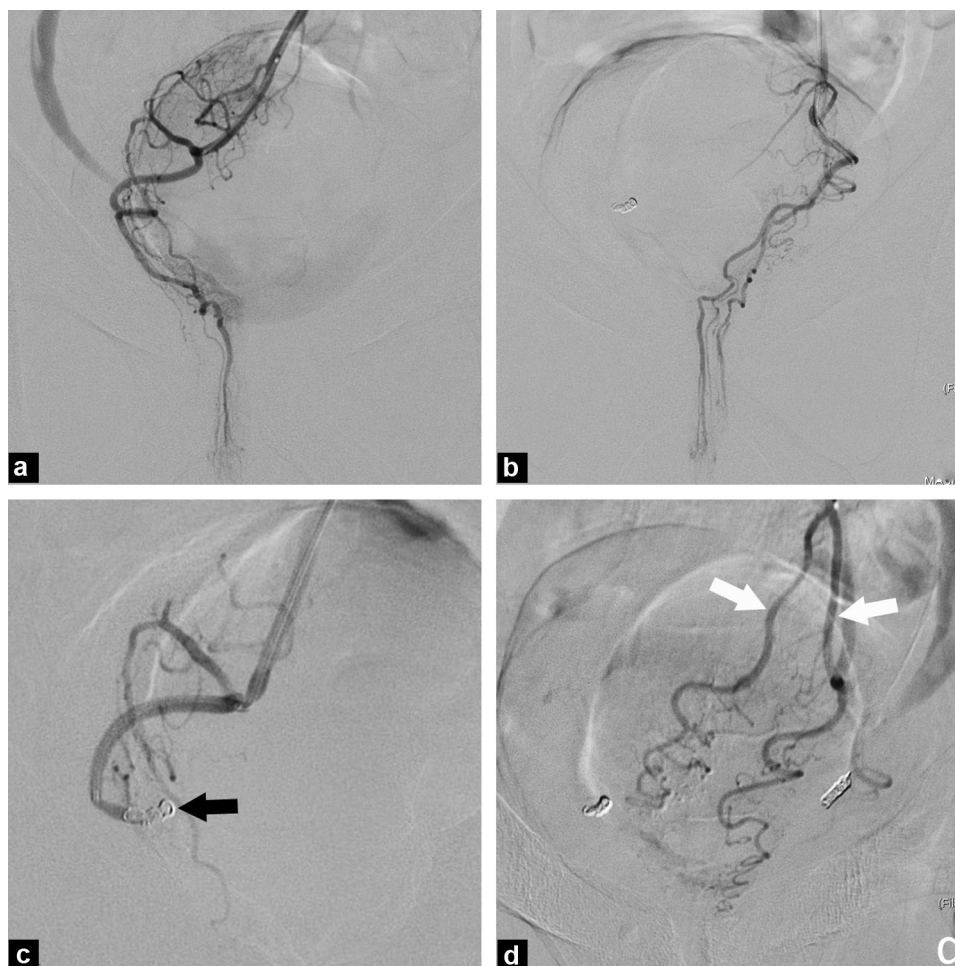
## Discussion

Surgical treatment is indicated for 10% of patients with hemorrhoidal disease [1]. Today, the reference technique is still Milligan and Morgan's open hemorrhoidectomy [2]. The need to obtain the least painful post-operative period possible, to ensure a rapid return to social and professional activities, and to reduce the cost of treatment, if possible by treating as an outpatient, have, since the 1990s, led various teams to propose new surgical procedures.

Circular stapled anopexy, first described by Paul-Antoine Lehur for treating rectal bleeding complicating the evolution of porto-caval hypertension, was offered by Antonio Longo for treating hemorrhoidal disease in 1995 [3]. Many studies have compared this stapling treatment with

conventional hemorrhoidectomy. Their results have been reported in several meta-analyses [12–14]. It appears that the main advantages of circular stapled anopexy are the reduction in the duration of surgery and the mean length of hospitalization, and the better rate of post-operative satisfaction. Indeed, pain is less intense and disappears more quickly when compared with results observed after classic operating techniques. However, rates of recurrence are higher, exceeding 10% [13–15]. Advanced prolapse (stage IV) does not respond to this treatment and today is no longer included in the indications. Overall, the risk of complications following Milligan and Morgan's or Longo's procedure is estimated as 15–20% of cases depending on the study [16–18]. They are usually non-specific benign complications, which are variously described depending on the series, grouping together hemorrhagic complications (4–17%), the risk of acute urine retention (0.3–22%), stenosis (0.8–20%), fecaloma, fissures, anal incontinence, exudation, delayed healing, and abscess. In addition, rare but nevertheless severe complications have been reported following stapled circular anopexy (rectal perforation, retroperitoneum, retroperitoneal sepsis, rectal stenosis, rectovaginal





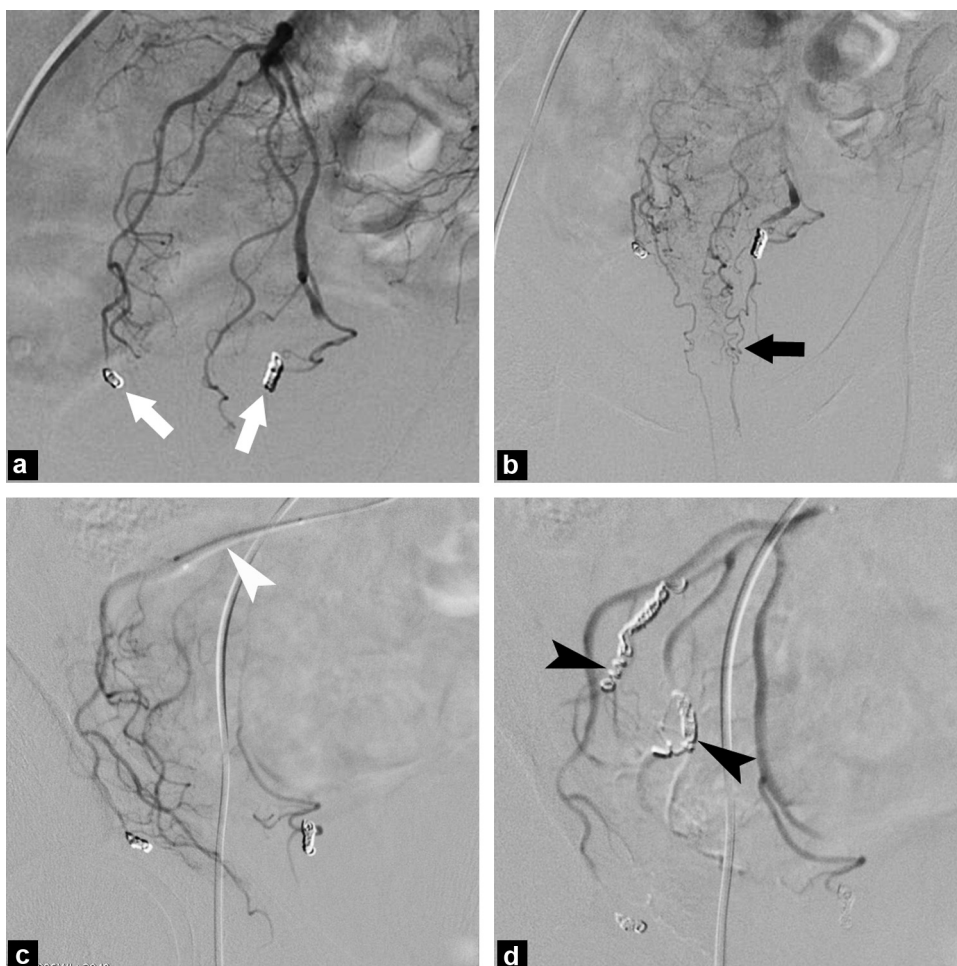
**Figure 2.** Patient no. 1. First episode of embolization: a: microcatheterization of the right SRA; b: microcatheterization of the left SRA; c: microcoil embolization of the right SRA; d: control after embolization of the left and right SRAs. Note the persistence of the posterior network (white arrow).

fistula). Several cases of post-operative peritonitis due to rectal perforation have also been reported, requiring emergency laparotomy with colostomy (19).

Elective Doppler-guided hemorrhoidal artery ligation (DG-HAL) via the transanal route with mucopexy was developed with the idea that minimally invasive surgery, more precise than elastic band ligation performed blind, would be likely to reduce the mean duration of hospitalization and surgical aggression, while improving the quality of post-operative recovery [4]. Described for the first time in 1995, this technique consists of Doppler-guided ligation of the terminal branches of the superior rectal artery to reduce the arterial supply to the hemorrhoids. No tissue resection is necessary unlike with the other techniques. This method, comparable to the elastic band ligations performed blind for several decades, is effective in internal hemorrhoidal disease where there is no prolapse (stage II). Several descriptive studies [19–24] have reported a short-term efficacy rate, for small series, of about 90%, and between 70 and 92% in the longer term (follow-up time varying from 6 to 46 months). Post-operative pain was present in 1 to 6% of cases. It was usually relieved by non-opioid analgesics. The rate of complications was low, evaluated to be between 2 and 12%:

rectal bleeding (4.3%), hemorrhoidal thrombosis (1.8%), fissures (0.8%), acute urine retention (0.7%). Faucheron et al. described a rate of recurrence of 12% at one year. It was 9% in the review of the literature by Giordano et al. Some authors even offer to perform vascular ligation which is not Doppler-guided; for this, they place a series of virtually circumferential ligatures at the expected anatomical position of the terminal branches of the superior rectal arteries. All of these ligation methods require the use of specific equipment, particularly an anoscope with a window allowing the position of the stitches to be measured relative to the dentate line: indeed, the ligatures would be extremely painful if positioned too low and ineffective if placed too high. An ultrasound generator and a disposable Doppler probe are also required. This budget is sometimes thought to be too high for consideration in a purchasing program. In addition, in France, these methods are not validated for health establishments and are not included in the French list of common classifications of medical procedures (CCAM).

Given the miniaturization of embolization equipment, occlusion of the superior rectal arteries can nowadays be performed via the endovascular route. Selective angiography can also produce a complete map of the superior rectal



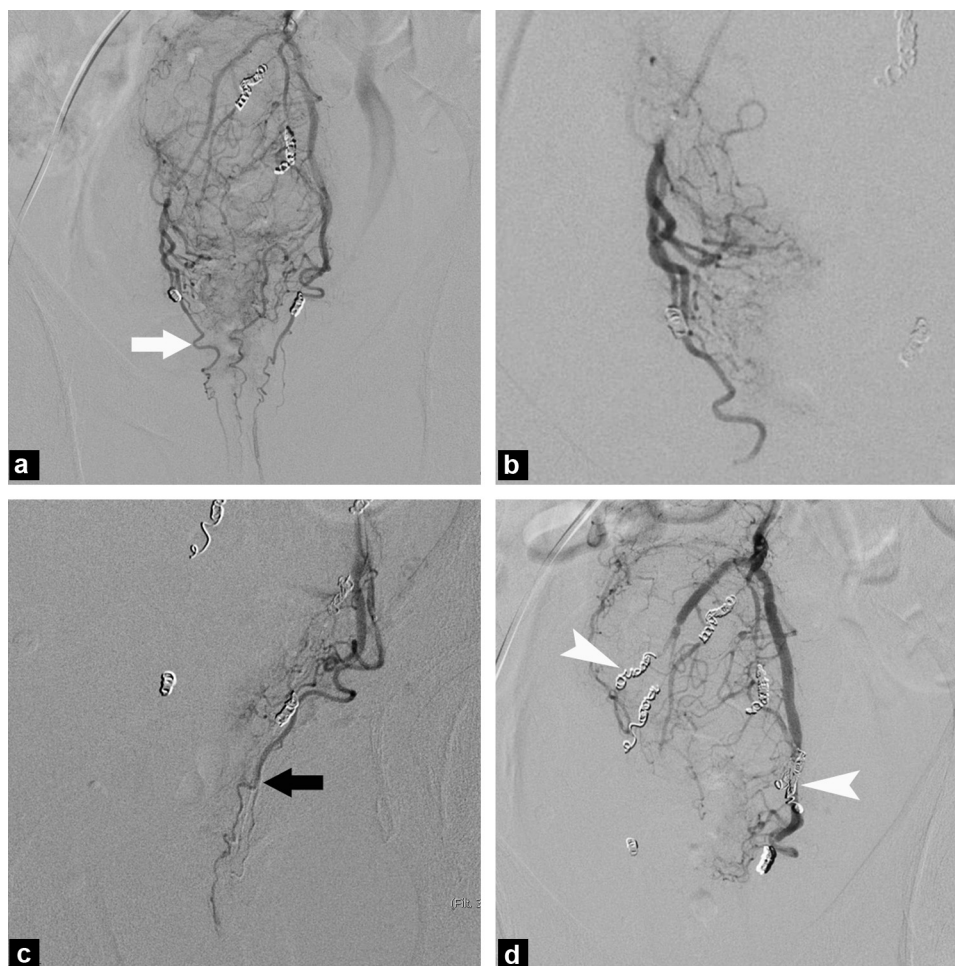
**Figure 3.** Patient no. 1. Second episode of embolization: a: opacification of the SRAs. Note the complete occlusion of the right and left branches by the coils (white arrows); b: terminal parts of the SRAs revascularized by the posterior branches (white arrow); c: microcatheterization of the posterior branches (white arrow); d: control after microcoil embolization (white arrows). There is no longer any visible vascularization at this level for the inferior part of the rectum.

vascular network. Embolization is therefore the only alternative technique enabling as complete as required occlusion of the superior rectal branches.

To date, no study has evaluated the feasibility of this method for treating rectal bleeding complicating hemorrhoidal disease. Several case studies have demonstrated its feasibility for treating acute hemorrhage of various origins [6–11]. The potential benefits of access via the endovascular route are the selectivity of the embolization and the absence of direct anorectal trauma. Better results can therefore be expected with reduced morbidity. The risks of femoral access are slight.

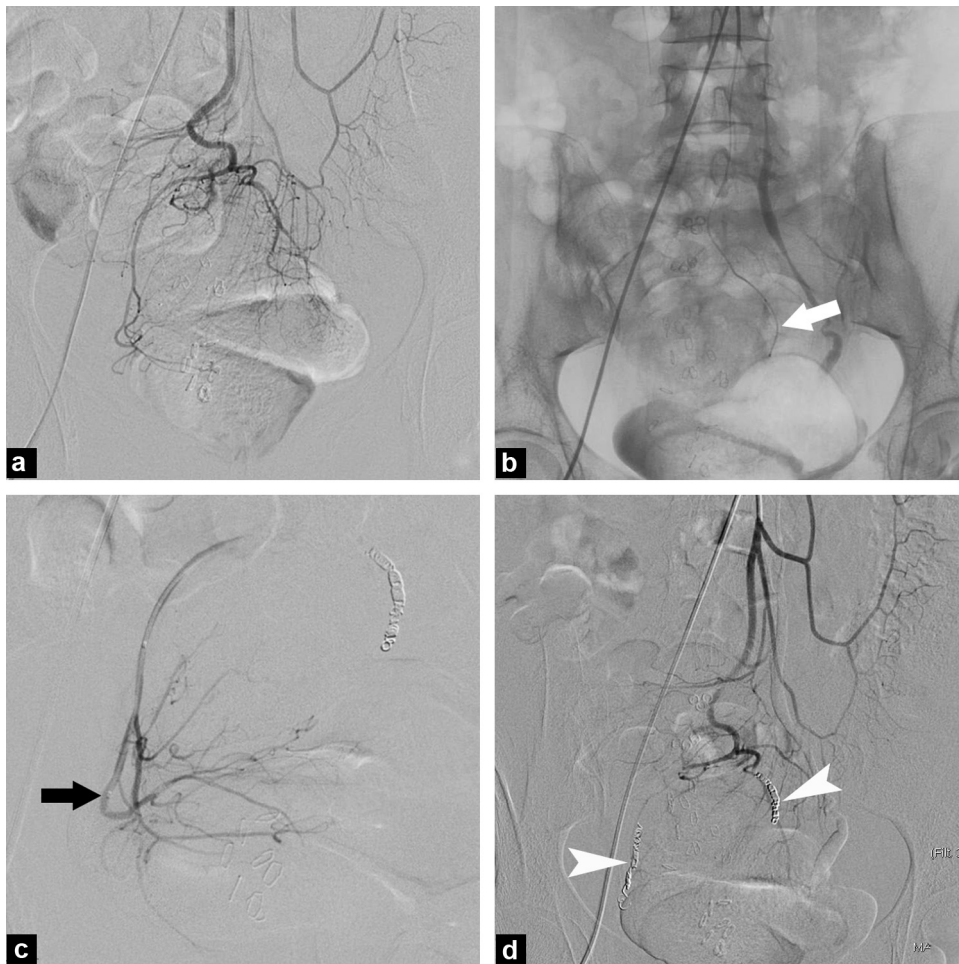
There were major differences in vascularization between the patients with a surgical history (no. 1 and 3) and the

patient who had not undergone a transanal procedure (patient no. 2). The arterial vascular network is extremely developed when a Longo type procedure has been performed previously. This explains the recurrence of rectal bleeding in these two patients and the need for very complete embolization for patient no. 1 to obtain cessation of rectal bleeding. A single embolization procedure completely stopped the hemorrhages in patient no. 2. It can therefore be hypothesized that embolization would be more effective and technically simpler in the absence of prior surgical treatment. After surgery, embolization should probably be more complete, including all the branches. A phase 2 study is starting in our establishment to confirm the efficacy and safety of this approach as an alternative to surgical treatment.

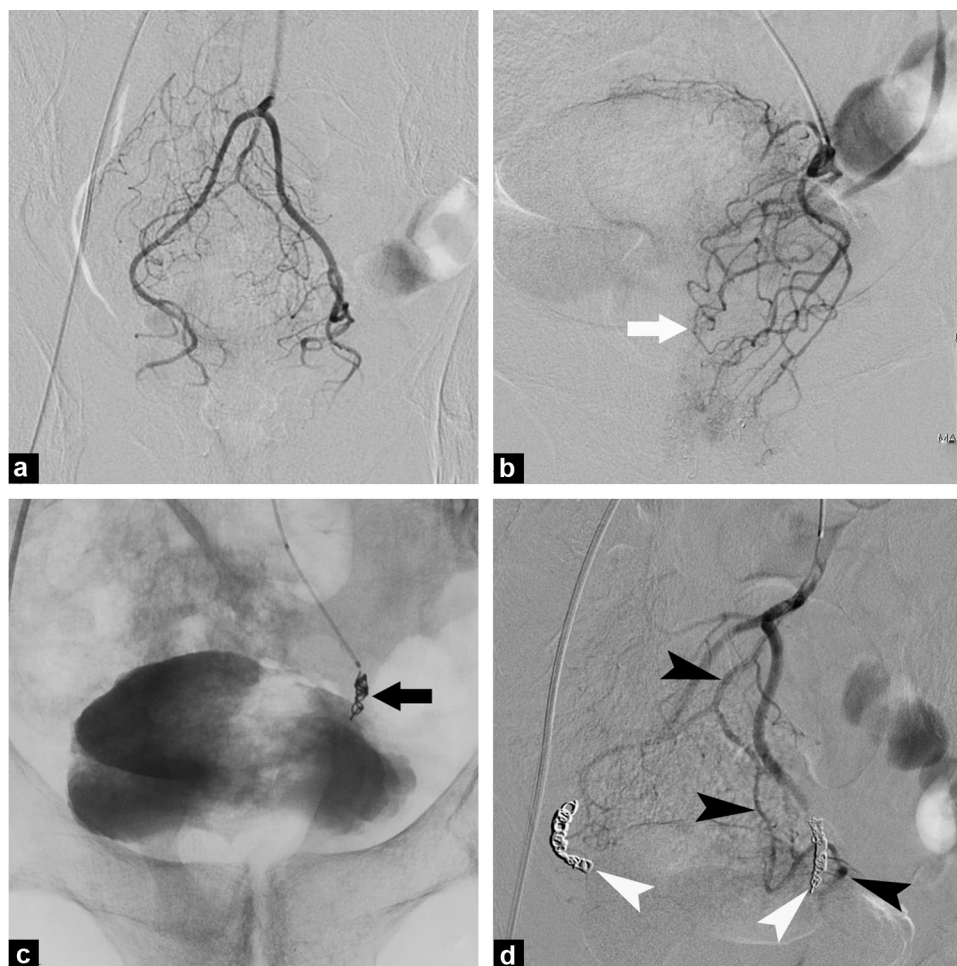


**Figure 4.** Patient no. 1. Third episode of embolization: a: opacification of the SRAs. Note the revascularization of the terminal part of the rectum (arrow); b: microcatheterization of the origin of the right SRA before embolization; c: microcatheterization of the distal part of a dividing branch of the left SRA. Note the revascularization of the terminal part of the rectum (arrow); d: control after microcoil embolization (white arrows). There is no longer any vascularization visible at this level for the inferior part of the rectum.





**Figure 5.** Patient no. 2: a: opacification of the proximal superior rectal branches. Relative to patient no. 1, vascularization of the lower rectum is much less developed; b: microcatheter in place in the left SRA before embolization (white arrow); c: microcatheter in place in the right SRA before embolization (white arrow). Note the coils inserted in the left SRA (black arrow); d: control after microcoil embolization (white arrows). There is no longer any vascularization visible for the inferior part of the rectum.



**Figure 6.** Patient no. 3: a–b: opacification of the proximal superior rectal branches and the left SRA. In this case, the same type of hypervascularization (white arrow) is found as in patient no. 1 (Fig. 1b,c); c: microcoil embolization of the left SRA (white arrow); d: control after microcoil embolization (white arrows). Posterior branches persist which will take over the distal vascularization of the rectum (black arrows).

## Conclusion

To conclude, the case studies of these three patients treated by embolization for hemorrhoids suggest that coil embolization of the SRAs is technically feasible, safe and well-tolerated. Additional studies are needed to evaluate the efficacy of this new “emborrhoid” technique in the management of hemorrhoidal disease.

## Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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