

# World Journal of *Clinical Cases*

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**REVIEW**

- 3683** Colorectal cancer: The epigenetic role of microbiome  
*Sabit H, Cevik E, Tombuloglu H*

**ORIGINAL ARTICLE****Case Control Study**

- 3698** Human podocyte injury in the early course of hypertensive renal injury  
*Sun D, Wang JJ, Wang W, Wang J, Wang LN, Yao L, Sun YH, Li ZL*

**Retrospective Cohort Study**

- 3711** Relationship between acute hypercarbia and hyperkalaemia during surgery  
*Weinberg L, Russell A, Mackley L, Dunnachie C, Meyerov J, Tan C, Li M, Hu R, Karalapillai D*

**Retrospective Study**

- 3718** Surgical treatment of patients with severe non-flail chest rib fractures  
*Zhang JP, Sun L, Li WQ, Wang YY, Li XZ, Liu Y*
- 3728** Super-selective arterial embolization in the control of acute lower gastrointestinal hemorrhage  
*Ly LS, Gu JT*
- 3734** End-stage liver disease score and future liver remnant volume predict post-hepatectomy liver failure in hepatocellular carcinoma  
*Kong FH, Miao XY, Zou H, Xiong L, Wen Y, Chen B, Liu X, Zhou JJ*

**Observational Study**

- 3742** Treatment of hemorrhoids: A survey of surgical practice in Australia and New Zealand  
*Fowler GE, Siddiqui J, Zahid A, Young CJ*
- 3751** Relationship between homocysteine level and prognosis of elderly patients with acute ischemic stroke treated by thrombolysis with recombinant tissue plasminogen activator  
*Li J, Zhou F, Wu FX*

**CASE REPORT**

- 3757** Cystic fibrosis transmembrane conductance regulator functional evaluations in a G542X+/- IVS8Tn:T7/9 patient with acute recurrent pancreatitis  
*Caldrer S, Bergamini G, Sandri A, Vercellone S, Rodella L, Cerofolini A, Tomba F, Catalano F, Frulloni L, Buffelli M, Tridello G, de Jonge H, Assael BM, Sorio C, Melotti P*

- 3765** Ulcerated intussuscepted jejunal lipoma-uncommon cause of obscure gastrointestinal bleeding: A case report  
*Cuciureanu T, Huiban L, Chiriac S, Singeap AM, Danciu M, Mihai F, Stanciu C, Trifan A, Vlad N*
- 3772** Ultrasonographic evaluation of the effect of extracorporeal shock wave therapy on calcific tendinopathy of the rectus femoris tendon: A case report  
*Lee CH, Oh MK, Yoo JI*
- 3778** Contrast-enhanced computed tomography findings of a huge perianal epidermoid cyst: A case report  
*Sun PM, Yang HM, Zhao Y, Yang JW, Yan HF, Liu JX, Sun HW, Cui Y*
- 3784** Iatrogenic crystalline lens injury during intravitreal injection of triamcinolone acetonide: A report of two cases  
*Su J, Zheng LJ, Liu XQ*
- 3792** Sagliker syndrome: A case report of a rare manifestation of uncontrolled secondary hyperparathyroidism in chronic renal failure  
*Yu Y, Zhu CF, Fu X, Xu H*
- 3800** Pre-eclampsia with new-onset systemic lupus erythematosus during pregnancy: A case report  
*Huang PZ, Du PY, Han C, Xia J, Wang C, Li J, Xue FX*
- 3807** Unilateral congenital scrotal agenesis with ipsilateral cryptorchidism: A case report  
*Fang Y, Lin J, Wang WW, Qiu J, Xie Y, Sang LP, Mo JC, Luo JH, Wei JH*
- 3812** Metastatic infection caused by hypervirulent *Klebsiella pneumonia* and co-infection with *Cryptococcus meningitis*: A case report  
*Shi YF, Wang YK, Wang YH, Liu H, Shi XH, Li XJ, Wu BQ*
- 3821** Allergic fungal rhinosinusitis accompanied by allergic bronchopulmonary aspergillosis: A case report and literature review  
*Cheng KJ, Zhou ML, Liu YC, Zhou SH*
- 3832** Invasive aspergillosis presenting as hilar masses with stenosis of bronchus: A case report  
*Su SS, Zhou Y, Xu HY, Zhou LP, Chen CS, Li YP*
- 3838** Retropharyngeal abscess presenting as acute airway obstruction in a 66-year-old woman: A case report  
*Lin J, Wu XM, Feng JX, Chen MF*
- 3844** Thoracoscopic segmentectomy assisted by three-dimensional computed tomography bronchography and angiography for lung cancer in a patient living with situs inversus totalis: A case report  
*Wu YJ, Bao Y, Wang YL*
- 3851** Single-lung transplantation for pulmonary alveolar microlithiasis: A case report  
*Ren XY, Fang XM, Chen JY, Ding H, Wang Y, Lu Q, Ming JL, Zhou LJ, Chen HW*

- 3859** Respiratory failure and macrophage activation syndrome as an onset of systemic lupus erythematosus: A case report  
*Sun J, Wang JW, Wang R, Zhang H, Sun J*
- 3866** Diagnosis of gastric duplication cyst by positron emission tomography/computed tomography: A case report  
*Hu YB, Gui HW*
- 3872** Peritoneal cancer after bilateral mastectomy, hysterectomy, and bilateral salpingo-oophorectomy with a poor prognosis: A case report and review of the literature  
*Ma YN, Bu HL, Jin CJ, Wang X, Zhang YZ, Zhang H*
- 3881** Apatinib for treatment of a pseudomyxoma peritonei patient after surgical treatment and hyperthermic intraperitoneal chemotherapy: A case report  
*Huang R, Shi XL, Wang YF, Yang F, Wang TT, Peng CX*
- 3887** Novel frameshift mutation causes early termination of the thyroxine-binding globulin protein and complete thyroxine-binding globulin deficiency in a Chinese family: A case report  
*Dang PP, Xiao WW, Shan ZY, Xi Y, Wang RR, Yu XH, Teng WP, Teng XC*
- 3895** Diffuse large B-cell lymphoma arising from follicular lymphoma with warthin's tumor of the parotid gland - immunophenotypic and genetic features: A case report  
*Wang CS, Chu X, Yang D, Ren L, Meng NL, Lv XX, Yun T, Cao YS*
- 3904** Exogenous endophthalmitis caused by *Enterococcus casseliflavus*: A case report  
*Bao QD, Liu TX, Xie M, Tian X*

**LETTER TO THE EDITOR**

- 3912** Microbial transglutaminase should be considered as an environmental inducer of celiac disease  
*Lerner A, Matthias T*

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## Retrospective Study

## Super-selective arterial embolization in the control of acute lower gastrointestinal hemorrhage

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**Author contributions:** Lv LS and Gu JT contributed equally to this work and were considered as co-first authors; Lv LS and Gu JT designed the research, collected and analyzed the data, and wrote the paper.

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## Abstract

## BACKGROUND

Acute gastrointestinal bleeding is an emergency condition that can lead to significant morbidity and mortality. Embolization is considered the preferred therapy in the treatment of lower gastrointestinal bleeding when it is unrealistic to perform the surgery or vasopressin infusion in this population. Treatment of acute lower gastrointestinal (GI) bleeding (any site below the ligament of Treitz) using this technique has not reached a consensus, because of the belief that the risk of intestinal infarction in this condition is extremely high. The purpose of the study is to evaluate the effectiveness and safety of this technique in a retrospective group of patients who underwent embolization for acute lower GI bleeding.

## AIM

To evaluate the efficacy and safety of super-selective arterial embolization in the management of acute lower GI bleeding.

## METHODS

A series of 31 consecutive patients with angiographically demonstrated small intestinal or colonic bleeding was retrospectively reviewed. The success rate and complication rate of super-selective embolization were recorded.

## RESULTS

Five out of thirty-one patients (16.1%) could not achieve sufficiently selective catheterization to permit embolization. Initial control of bleeding was achieved in 26 patients (100%), and relapsed GI bleeding occurred in 1 of them at 1 wk after the operation. No clinically apparent bowel infarctions were observed in patients undergoing embolization.

## CONCLUSION

Super-selective embolization is a safe therapeutic method for acute lower GI



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bleeding, and it is suitable and effective for many patients suffering this disease. Importantly, careful technique and suitable embolic agent are essential to the successful operation.

**Key words:** Lower gastrointestinal bleeding; Embolization; Infarction; Bowel; Hemorrhage; Selective arterial embolization

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**Core tip:** Transcatheter embolization has been accepted as an effective and safe method for treating acute upper gastrointestinal (GI) bleeding. Treatment of acute lower GI bleeding (any site below the ligament of Treitz) using this technique has not reached a consensus, because of the belief that the risk of intestinal infarction in this condition is extremely high. The purpose of the study is to evaluate the effectiveness and safety of this technique in a retrospective group of patients who underwent embolization for acute lower GI bleeding.

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## INTRODUCTION

Transcatheter embolization has been accepted as an effective and safe method for treating acute upper gastrointestinal (GI) bleeding<sup>[1-7]</sup>. Treatment of acute lower GI bleeding (any site below the ligament of Treitz) using this technique has not reached a consensus, because of the belief that the risk of intestinal infarction in this condition is extremely high<sup>[8-12]</sup>. The purpose of the study is to evaluate the effectiveness and safety of this technique in a retrospective group of patients who underwent embolization for acute lower GI bleeding.

## MATERIALS AND METHODS

This study is a retrospective review of patients who underwent super-selective arterial embolization for acute lower GI bleeding from June 2008 to January 2017. The study included 31 patients with 24 men and 7 women whose average age was 66.3 (from 36 to 81) years. They suffered from life-threatening acute GI bleeding. Twenty-one patients were in frank cardiogenic shock, with systolic blood pressure levels less than 80 mmHg. Packed red blood cell transfusions with the amount ranging between 4 and 11 units were transfused to compensate for massive blood loss. Moreover, 14 patients underwent endoscopic evaluation before radiologic intervention.

Embolization therapy was performed on patients in a specialized angiographic suite with advanced diagnostic and interventional therapeutic capabilities. Standard 4-Fr or 5 Fr catheters for selective diagnostic arteriography were used in each patient. When the site of active bleeding was seen, super-selective catheterization was performed using latest generation of co-axial catheters. The clinicians planned to perform embolization in all 31 patients, and ultimately, it was performed in 26 patients. For the remaining 5 patients, sufficient space for safe embolization could not be achieved. Embolization that involved branches of the superior mesenteric artery was performed in 21 patients, and embolization that involved the inferior mesenteric artery was performed in 5 patients. The catheter tip was positioned just adjacent to the site of active bleeding whenever possible. Only gelfoam fragments of 1 to 2 mm were used as embolic agent in 16 of 26 patients. Microcoils from 2 mm to 4 mm in diameter were used in 10 of 26 patients, and the remaining 6 patients were additionally administered with a few polyvinyl alcohol particles (PVA; Contour emboli 355 µm to 500 µm) to achieve complete hemostasis. Control of hemorrhage, as evidenced by cessation of extravasation and obliteration of pseudoaneurysms, was confirmed by repeat arteriography.

After embolization, they were monitored for postoperative bleeding and signs of

intestinal infarction. Several outcomes were analyzed, including rate of initial technical success, rebleeding rate within 7 d after embolization, and complication rate of all patients.

## RESULTS

A total of 31 patients were involved in this experiment (24 males and 7 females), and the median age was 66.3 (range: 36 to 81 years) years. Transcatheter embolization was used in 26 of 31 patients with acute lower GI bleeding. There were mainly three kinds of embolization utilized to control the hemorrhage (Table 1). Initial technical success was obtained in 26 of 31 patients (83.8%) who were willing to undergo embolization. Sufficiently selective catheterization to permit embolization could not be achieved in 5 patients.

The bleeding was more likely to happen in the proximal colon and the outcome showed that the majority cases of hemorrhage were located in the right colon (Table 2). Embolization therapy resulted in successful hemostasis in all 26 patients (100%) in whom embolization was possible. Rebleeding at less than 7 d after embolization occurred only in 1 patient (3.8%). Rebleeding occurred at 1 d after embolization in this patient who went to the operating room for resection. Furthermore, no complication was recorded during the embolization. During the post-procedure period, no ischemic complication occurred, based on clinical observation of all patients and endoscopy in selected patients.

## DISCUSSION

Super-selective arterial embolization has become an effective method to rapidly and safely control upper GI bleeding<sup>[1,2,4,6,7,13]</sup>. In contrast to upper GI bleeding, bleeding originating distally to the ligament of Treitz has always been viewed more conservative due to the bowels, especially the large bowels. Because a relative deficiency of collateral blood supply, transcatheter embolization is a challenging procedure with a significant risk of bowel ischemia<sup>[8,10,12,14]</sup>. Transcatheter arterial embolization for lower GI bleeding was first reported in 1975<sup>[15]</sup>. Consequently, several case reports and small series followed, showing excellent results. Furthermore, in the early 1980s, complications of bowel infarction were recognized. Han *et al*<sup>[10]</sup> reported 23 cases of colonic embolization at five hospitals, with three episodes of bowel necrosis. Then embolization for lower GI bleeding was reserved in patients with highest surgical risk. With improvements in coaxial catheters and embolic agents (microcoils, gelfoam, and PVA particles), there was renewed interest in embolization in the treatment of lower GI bleeding. Okazaki *et al*<sup>[16]</sup> published a series involving 10 consecutive embolizations in 9 patients for lower GI bleeding. They used microcatheters and PVA particles to achieve hemostasis in all cases in which no case of bowel infarction and only 2 cases of asymptomatic mucosal ischemia were noted by endoscopy.

In this present study, we approached 21 patients with lower GI bleeding who were willing to undergo embolization. Embolization was technically possible in 16 patients, and hemostasis was achieved in all of them. One patient (6%) experienced rebleeding and required bowel resection. Five patients could not achieve embolization because the catheter tip could not be positioned adjacent to the site of active bleeding. It must be emphasized that safe and effective embolization requires super-selective catheterization. Distal catheter may be desirable in some cases, for which a co-axial system is often required. We perform embolization as distally as possible. If the catheter tip was not in a sufficiently peripheral position, embolization was not implemented.

Reported rate of bowel ischemia after embolization ranged from 0% to 22% in the literature<sup>[8,12,17]</sup>. In this study, no patient developed bowel infarction. To avoid bowel infarction after embolization, careful technique and preparation for turning down the embolization are pivotal, particularly when a suitable catheter position cannot be achieved<sup>[14,18,19]</sup>. Nevertheless, it is also important to choose a suitable embolic agent. Various options are available for embolic agent, which include microcoils, gelfoam, and PVA, and the outcome also varies according to which material is chosen and how it is utilized. Gelfoam is used as a temporary embolic agent and is relatively safe, but it is not conducive to complete embolization and the rate of recurrent bleedings is higher than other embolic agents. PVA particles achieve rapid and complete embolization of target artery, regardless of the artery type and diameter. However, the complication rate is higher than other agents owing to the high risk of non-target



**Table 1 Embolization agents**

Embolization agents	No. of patients, <i>n</i> = 26
Gelfoam	16
Microcoils	4
Microcoils + PVA	6

PVA: Polyvinyl alcohol.

embolization. Microcoils are the embolic agents used in 10 of 26 patients. They can be clearly seen on the lateral fluoroscopic image and are easily and accurately positioned. Although we used gelfoam fragments and PVA particle safely and successfully, there are also some disadvantages of these agents. For example, they are not so radiopaque that the final resting position cannot be easily controlled, which increases the difficulty to manipulate the quantity of the agents. We performed embolization with gelfoam fragments and PVA particles, which is a less tightly controlled procedure than embolization with microcoils and is more likely to trigger bowel infarction.

In summary, our results suggest that super-selective arterial embolization for acute lower GI hemorrhage is effective and safe. This procedure should be the initial treatment in patients who suffer severe bleeding that requires angiography and have indication for super-selective catheterization. With super-selective embolization, the risk of symptomatic bowel ischemia can be minimized.

Table 2 Sites of embolization

Sites of embolization	No. of patients, <i>n</i> = 26
Right colon	13
Middle colon	8
Left colon	4
Rectum	4
Others	2

## ARTICLE HIGHLIGHTS

### Research background

Acute gastrointestinal (GI) bleeding is an emergency condition that can lead to significant morbidity and mortality. Embolization is considered the preferred therapy in the treatment of lower GI bleeding when it is unrealistic to perform the surgery or vasopressin infusion in this population. Treatment of acute lower GI bleeding (any site below the ligament of Treitz) using this technique has not reached a consensus because of the belief that the risk of intestinal infarction in this condition is extremely high. The purpose of the study is to evaluate the effectiveness and safety of this technique in a retrospective group of patients who underwent embolization for acute lower GI bleeding.

### Research motivation

Because of a relative deficiency of collateral blood supply, transcatheter embolization is a challenging procedure with a significant risk of bowel ischemia.

### Research objectives

To evaluate the efficacy and safety of super-selective arterial embolization in the management of acute lower GI bleeding.

### Research methods

This study is a retrospective review of patients who underwent super-selective arterial embolization for acute lower GI bleeding. After embolization, they were monitored for postoperative bleeding and signs of intestinal infarction. Several outcomes were analyzed, including rate of initial technical success, rebleeding rate within 7 d after embolization, and complication rate.

### Research results

The bleeding was more likely to happen in the proximal colon, and the outcome showed that the majority cases of hemorrhage were located in the right colon. Embolization therapy resulted in successful hemostasis in all 26 patients (100%) in whom embolization was possible. Rebleeding at less than 7 d after embolization occurred only in 1 patient (3.8%). Rebleeding occurred at 1 d after embolization in this patient who went to the operating room for resection. No complication was recorded during the embolization and during the post-procedure period, and no ischemic complication occurred.

### Research conclusions

Super-selective arterial embolization for acute lower GI hemorrhage is effective and safe. This procedure should be the initial treatment in patients who suffer severe bleeding that requires angiography and have indication for super-selective catheterization. With super-selective embolization, the risk of symptomatic bowel ischemia can be minimized.

### Research perspectives

To avoid bowel infarction after embolization, careful technique and preparation for turning down the embolization are pivotal, particularly when a suitable catheter position cannot be achieved. In addition, it is also important to choose a suitable embolic agent.

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