



# Transcatheter Arterial Embolization for Palliation of Uterine Body Cancer Bleeding

자궁체부암 출혈에 대한 보존적 치료로서의 경카테터 동맥 색전술

Jaeyeon Choi, MD , Ji Hoon Shin, MD\* , Hee Ho Chu, MD

Department of Radiology and Research Institute of Radiology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

## ORCID iDs

Jaeyeon Choi <https://orcid.org/0000-0002-6397-7439>

Ji Hoon Shin <https://orcid.org/0000-0001-6598-9049>

Hee Ho Chu <https://orcid.org/0000-0002-3903-0026>

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## \*Corresponding author

Ji Hoon Shin, MD  
Department of Radiology and  
Research Institute of Radiology,  
Asan Medical Center,  
University of Ulsan,  
College of Medicine,  
88 Olympic-ro 43-gil, Songpa-gu,  
Seoul 05505, Korea.

Tel 82-2-3010-4380

Fax 82-2-476-0090

E-mail [jhshin@amc.seoul.kr](mailto:jhshin@amc.seoul.kr)

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**Purpose** This study aimed to evaluate the efficacy and safety of transcatheter arterial embolization (TAE) for bleeding due to uterine body cancer.

**Materials and Methods** In this retrospective study, six patients with varying types of uterine body cancer who underwent TAE for bleeding control were investigated. Angiographic findings, cross-sectional images, TAE details, and clinical outcomes were studied. Technical and clinical success rates were calculated.

**Results** The identified patients had endometrioid adenocarcinoma, sarcoma, and gestational trophoblastic neoplasia, and most were patients with advanced-stage cancer. In four patients, tumor bleeding presented as vaginal bleeding. Technical success was achieved in all seven TAE procedures in six patients. Two patients with recurrent masses who had undergone hysterectomy presented with hematochezia, and TAE was able to provide technical success in these patients as well. The clinical success rate was 50%, indicating bleeding control for > 1 week. Rebleeding was directly associated with death in one patient. On the following day, mild fever was observed in one patient.

**Conclusion** TAE can be considered an effective and safe method of bleeding control for uterine body cancer, especially during critical periods throughout the disease course of patients with inoperable, advanced-stage cancer.

**Index terms** Embolization, Therapeutic; Uterine Neoplasms; Endometrial Cancer; Uterine Artery Embolization

## INTRODUCTION

Endometrial cancer, or more broadly, uterine body cancer, is now the most common gyne-

cologic malignancy in developed countries. Its incidence is increasing in many countries including South Korea, where the incidence of uterine body cancer has surpassed that of cervical cancer as of 2019, according to the Korea Central Cancer Registry (1).

Patients commonly present with vaginal bleeding, and while this is mostly managed conservatively, the definite, mainstay of treatment for uterine body cancer is surgery including hysterectomy with bilateral salpingo-oophorectomy. However, in advanced stages or in recurrent diseases, surgery may not be applicable and other measures such as radiation therapy or chemotherapy are taken (2, 3). In these cases, additional options for bleeding control need to be considered, since the tumor is remaining in the pelvic cavity, often in close relation to the numerous vessels within, all of which have the potential to cause bleeding.

Transcatheter arterial embolization (TAE) is now widely used in various gynecologic and obstetric situations. The most well-known indications include symptomatic uterine fibroids and intractable postpartum hemorrhage (4, 5). However, the spectrum of applicable situations is much wider, and includes other benign conditions such as adenomyosis, but also non-benign conditions such as bleeding due to advanced stage gynecologic malignancies. While cases of successful TAE of refractory bleeding related to cervical cancer have often been reported and widely studied (6, 7), there have been very few reports regarding TAE for bleeding due to cancers involving the uterine body. In this study, we evaluated the safety and efficacy of TAE performed in uterine body cancer patients presenting with bleeding.

## MATERIALS AND METHODS

### PATIENT CHARACTERISTICS

The hospital institutional review board approved this retrospective study, and the requirement for informed consent was waived (IRB No. S2022-0644-0001). The data regarding patients who went through TAE due to tumor bleeding from uterine body cancer at our institution from June, 2001 to March, 2020 were retrospectively reviewed. Patients with uterine cervical cancer were not included in the study, and a total of six patients were identified. Tumor bleeding presented as vaginal bleeding or hematochezia, with varying degrees of bleeding from intermittent episodes of chronic bleeding, to acute, massive bleeding.

### TAE DETAILS

TAE was conducted in our institution by one of three expert interventional radiologists with 7–20 years of experience. After puncturing the femoral artery, internal iliac arteriograms were obtained, selective catheterization of the feeding arteries was performed, and the culprit arteries were embolized. Embolic materials included polyvinyl alcohol (PVA; Contour; Boston Scientific, Cork, Ireland), gelatin sponge particles (Gelfoam; Pharmacia & Upjohn, Kalamazoo, MI, USA), and microcoils (Tornado or microNester; Cook Medical, Bloomington, IN, USA), and were chosen depending on the operator's preference. Post-embolization angiography was performed immediately after the embolization procedure to evaluate if the target artery was completely excluded.

## STUDY ENDPOINT

According to the medical records of the patients, data regarding patient age, cancer type (pathology), The International Federation of Gynecology and Obstetrics (FIGO) stage, treatment history regarding the cancer, degree of bleeding, cross-sectional imaging, and details of TAE were obtained. Data regarding immediate follow-up including complications, long-term follow up and patient survival were also collected when available. Technical success rates and clinical success rates were calculated. Post-embolization complications were classified according to the Society of Interventional Radiology Classification System.

## DEFINITIONS

Technical success was defined as disappearance of contrast extravasation, or successful embolization of the target vessels leading to more than 90% disappearance of hypervascular tumor staining. Clinical success was defined as the absence of rebleeding within one week of TAE. Relevant CT scans were defined as CT scans obtained within 10 days prior to TAE.

## RESULTS

A total of six patients with varying types of uterine body cancer were included in the study (Table 1). The median age of patients was 58 years (range = 29–79 years). Two patients (patient no. 2, 5) had received hysterectomy, and were included due to bleeding from recurred tumor. Five patients had received chemotherapy, except one patient (patient no. 3) who was lost to follow-up after the initial diagnosis and had not received any treatment. None of the patients had received radiotherapy before TAE.

More than half of the patients ( $n = 4$  of 6) presented with vaginal bleeding. Two patients who had previously received hysterectomy presented with hematochezia due to fistulas between the bowel and recurrent masses within the pelvic cavity (Fig. 1). Four patients presented with chronic, persistent bleeding, one patient presented with chronic, intermittent bleeding, whereas one patient (patient no. 6) presented with an acute event of massive bleeding. One patient (patient no. 4) went through two sessions of TAE, and presented with vaginal bleeding on the first session, and hemoperitoneum due to tumor bleeding on the second session.

Out of six patients and seven procedures, relevant CT scans at the time of TAE were available in five procedures. In one patient who presented with acute massive bleeding (patient no. 6), evidence of active bleeding was seen on CT as contrast extravasation (Fig. 2). The rest of the CT scans showed a necrotic mass with or without vascular encasement.

Details of TAE including angiographic findings, embolized arteries, and embolic material are summarized in Table 1. On angiography, active bleeding was shown as contrast extravasation in none of the patients. Instead, angiography showed hypervascular tumor stainings within the uterus or pelvic cavity. The main feeders of the tumor staining were considered culprit arteries and subsequently embolized. The uterine arteries were embolized in four patients and the internal iliac arteries were embolized in two patients. Tumor feeders from uterine arteries or internal iliac arteries were selectively embolized in sessions in which tumor feeders were identified. Tumor feeders from the superior rectal artery and omental

Table 1. Details of Transcatheter Arterial Embolization

Age No. (Years)	Diagnosis	Operation	Symptoms Degree of Bleeding	CT Findings (Interval)	Angiographic Findings	Embolized Arteries	Embolization Material	Technical Success	Clinical Success	Remark	Survival (Days)/Cause of Death
1 29	GTN	-	Vaginal bleeding (chronic, persistent)	N/A	Entangled vascular nidus with early venous drainage, enlarged UAs	Both IIAs	PVA	Yes	Yes		20 years (alive)
2 47	Recurred MMMT	Abdominal hysterectomy (before recurrence)	Hematochezia (chronic, persistent)	Necrotic mass/VE/enterotumoral fistula (1 day)	Mild hypervascular TS with multiple feeders	Tumor feeders from both UAs, IIAs, SRA	GTS	Yes	Yes		48/disease progression
3 79	MMMT	-	Vaginal bleeding (chronic, persistent)	N/A (2 years)	Hypervascular TS in uterus	Both UAs	GTS	Yes	No		60/disease progression
4 51	Favor Ewing sarcoma	-	Vaginal bleeding (chronic, persistent)	Necrotic mass (2 days)	TS	Both UAs	GTS	Yes	Yes	Additional embolization after 6 months (below)	-
4 51	Favor Ewing sarcoma	-	Hemoperitoneum due to tumor oozing	Necrotic mass/peritoneal carcinomatosis (3 days)	TS in uterus and abdominal cavity	Both UAs Omental feeders	GTS	Yes	No		17/disease progression
5 66	Recurred endometrioid adenocarcinoma	Abdominal hysterectomy (before recurrence)	Hematochezia (chronic, intermittent)	Necrotic mass/VE/enterotumoral fistula (8 days)	TS with multiple feeders from left IIA	Tumor feeders from left IIA	GTS, coil	Yes	No	Palliative RT due 46/ to persistent hematochezia	46/hypovolemic shock due to bleeding
6 65	Endometrioid adenocarcinoma	-	Vaginal bleeding (acute, massive)	CE, necrotic mass (0 days)	Hypervascular TS in uterus	Both UAs	GTS	Yes	No	Fever (37.9°C)	44/disease progression

CE = contrast extravasation, GTN = gestational trophoblastic neoplasia, GTS = gelatin sponge particle, IIA = internal iliac artery, MMMT = malignant mixed Müllerian tumor, N/A = not available, PVA = polyvinyl alcohol, RT = radiation therapy, SRA = superior rectal artery, TS = tumor staining, UA = uterine artery, VE = vascular encasement

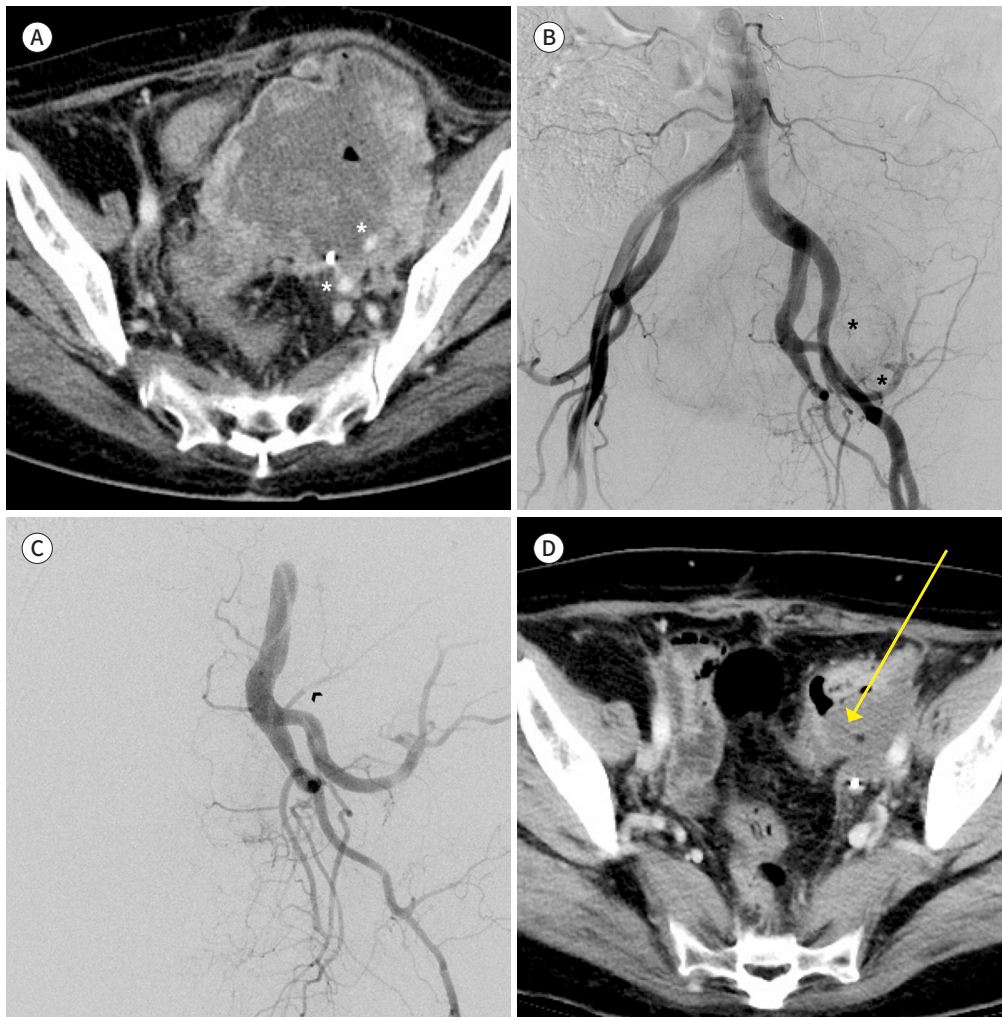
**Fig. 1.** A 66-year-old female (patient no. 5) presented with aggravated hematochezia and abdominal pain. The patient had undergone hysterectomy for endometrial cancer 14 months ago and was on chemotherapy due to tumor recurrence in the pelvic cavity.

**A.** A huge recurrent tumor mass is seen in the left pelvic cavity on the CT scan obtained on the day of visit. The tumor is invading the sigmoid colon, and encasing and narrowing the left external and internal iliac arteries (asterisks). Contrast extravasation is not seen.

**B.** Active bleeding is not observed on the aortogram. The aortogram shows a huge hypervascular tumor staining in the left pelvic cavity, supplied by multiple feeders (asterisks) from the left internal iliac arteries.

**C.** Selective embolization was performed with Gelfoam and a coil (arrowhead). Post-embolization angiography reveals markedly decreased tumor staining in the left pelvic cavity.

**D.** A CT scan obtained two months before the visit shows a recurrent tumor in the left pelvic cavity, with a fistula between the sigmoid colon and the mass (arrow).



branches were also embolized in two patients (patient no. 2, 4), respectively. In most of the sessions ( $n = 6$  of 7), bilateral arteries (e.g. both uterine or internal iliac arteries) were embolized. Selective embolization of the left IIA was performed in one patient (patient no. 5). The most used embolic material was gelatin sponge particles ( $n = 6$ ). Coils with gelatin sponge particles were used in one patient (patient no. 5), and PVA was used in another patient (patient no. 1).

After the procedure, there were no remaining bleeding focuses, and disappearance of over



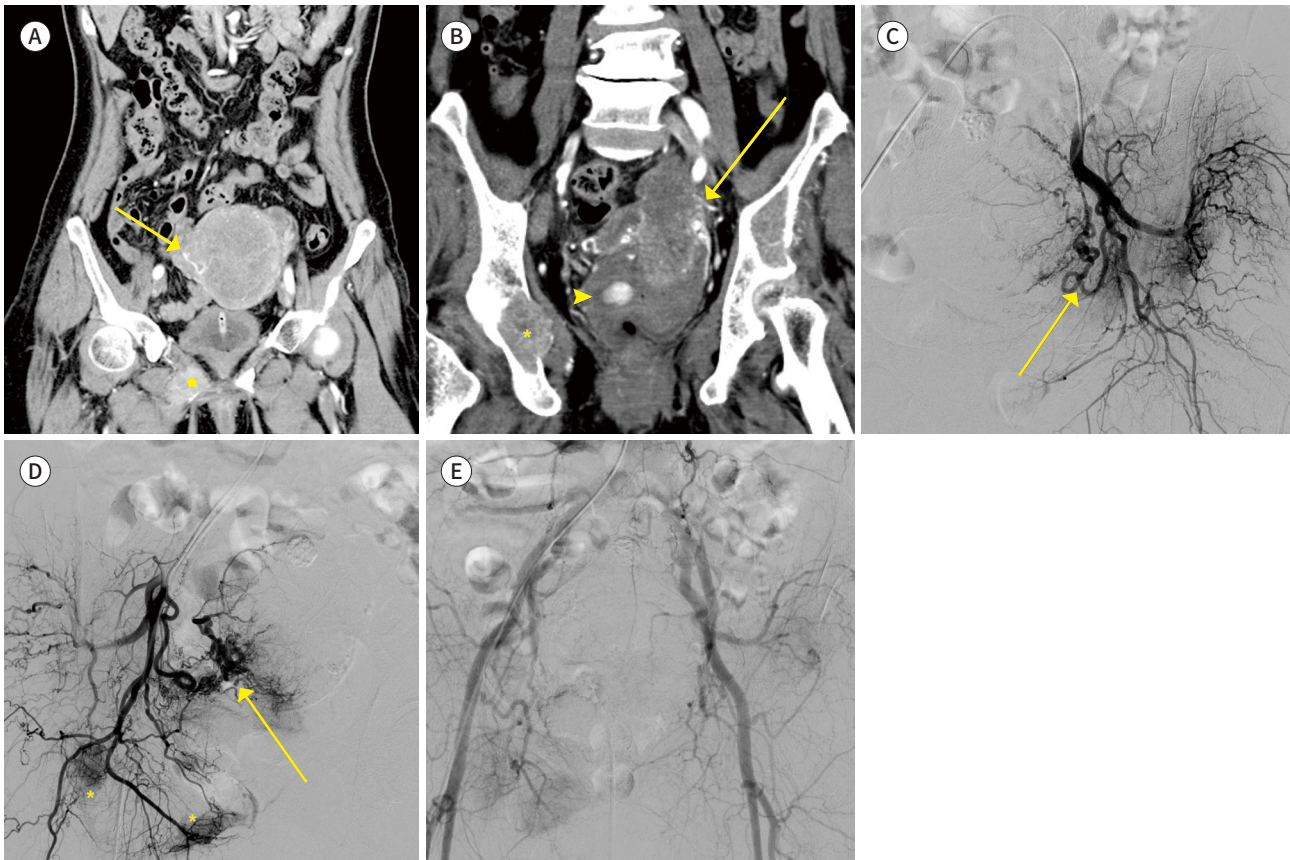
**Fig. 2.** A 65-year-old female (patient no. 6) with endometrial cancer presented with massive vaginal bleeding, and underwent a session of transcatheter arterial embolization.

**A, B.** CT scan performed immediately before the procedure shows a huge tumor mass in the uterus. The tumor is supplied by multiple feeders from the uterine arteries (arrows). Contrast extravasation due to active bleeding from the tumor is visible (arrowhead). Metastases in the right iliac and pubic bone are also noted (asterisks).

**C.** Hypervascular tumor stainings in the uterus supplied by the left uterine artery (arrow) are visible.

**D.** Hypervascular tumor stainings supplied by the right uterine artery (arrow), and bone metastases are visible (asterisks). Active bleeding is not shown on angiography of both internal iliac arteries.

**E.** Both uterine arteries were selectively embolized with Gelfoam. Post-embolization angiography shows near complete devascularization of the tumor in the uterus.



90% of the extent of tumor staining was seen in all patients, thus resulting in technical success in all patients. Bleeding control for at least one week from the procedure was seen in three patients, resulting in a clinical success rate of 50% (3/6). When a total of seven TAE were included, bleeding control for at least one week was achieved in 42.8% (3/7) of the treatments. Conservative measures were taken in patients who experienced re-bleeding.

There were no major complications during the immediate follow-up. One patient (patient no. 6) showed mild fever on the day after the procedure, which subsided after conservative management.

One patient (patient no. 4) went through a second session of TAE 6 months after the initial treatment due to hemoperitoneum related to tumor bleeding. In this second session, even though technical success was achieved, the patient shortly presented with recurrent bloody ascites presumably due to persistent tumor bleeding.

On follow up, most patients ( $n = 5$  of 6) expired within 60 days (median = 46, range = 17–60 days). One patient (patient no. 5) died of hypovolemic shock 47 days after the TAE. This patient exhibited persistent hematochezia after TAE, even after having received radiotherapy to the pelvis as a palliative measure to control the bleeding. Another session of TAE was considered in this patient, but eventually was not performed due to the patient's wishes. The others were terminal stage cancer patients at the time of TAE, and died of disease progression.

## DISCUSSION

Endovascular treatment is considered an effective therapeutic option for a wide range of gynecologic and obstetric conditions. Ever since the first reports of TAE for bleeding control of gynecologic malignancies in the 1970s (8, 9), more studies have been conducted over the past 40 years, implementing different treatment methods and technologies (6, 7, 10, 11), and showing the increasing role of TAE. These studies mainly dealt with cervical cancer bleeding, and the separate evaluation of TAE on bleeding control for cancers involving the uterine body has rarely been done, albeit its increasing incidence.

We investigated seven cases of TAE performed in uterine body cancer patients presenting with bleeding and assessed the efficacy and safety of the procedure on bleeding control. TAE showed a 100% rate of technical success and a 50% rate of clinical success. Put differently, TAE was able to provide immediate hemorrhagic control in all cases whereas half of the patients once again experienced some level of bleeding within a week.

This is in-keeping with the results of previous studies on TAE for gynecologic malignancy bleeding, which showed that recurrent hemorrhage after TAE was relatively common. One study (12) demonstrated that recurrent bleeding was particularly common when absorbable gelatin sponge was used, which was also the case in our study. Other studies with uterine cervical cancers (6, 7) also showed moderate rates of recurrent bleeding in the first few months after the procedure, which, however, were relatively less severe or more manageable by additional TAE or conservative measures. In our study, only one patient showed major bleeding which was directly associated with death, while in the others, re-bleeding was managed conservatively.

Angiography showed hypervascular tumor stainings without contrast extravasation or pseudoaneurysm formation. This seems to be related to the fact that most patients presented with persistent tumor oozing bleeding instead of an acute event of massive bleeding. Considering that technical success was achieved in all of these cases, it may be useful to empirically embolize hypervascular tumor stainings for the control of tumor oozing, even when active bleeding and its culprit artery is not identified. Further, oozing bleeding and hypervascular tumor staining without contrast extravasation or pseudoaneurysm may be suggested as a characteristic of uterine body cancer, although further validation with larger subjects is needed.

It may be worthy to note that two cases of TAE performed in hysterectomy state patients with recurrent masses were also included in this study. In these patients, tumor bleeding presented not as vaginal bleeding but as hematochezia. On cross-sectional images, fistulas between the recurred mass and the bowel were seen, thus accounting for the patients' symptoms of hematochezia. Immediate bleeding control was also achieved by embolization of

feeding vessels from uterine and internal iliac arteries. Thus, uterine body cancer may present with other ways of bleeding than vaginal bleeding, and even in recurrent masses arising after the initial surgery, TAE may be considered as an option for bleeding control.

Five out of six patients expired within 60 days in our study due to disease progression, and the true longer-term impact of TAE in these patients' general outcome and survival is unknown. Nonetheless, TAE was able to provide a high level of immediate bleeding control, and the procedure itself was not associated with any major complications. Thus, we believe that TAE can be considered as an effective way of hemorrhagic control in critical periods in the disease course of advanced and terminal stage cancer patients.

This study is limited in its small number of included patients, being a single centered study, the retrospective nature, and the relatively short period of follow-up. However, TAE of uterine body cancers has never been solely investigated, and we believe that this study not only demonstrates the efficacy and potential of TAE of these types of cancers, but also serve as a pilot for future studies. Also, the one-week period of bleeding control which we defined as clinical success may be rather short in terms of cost-effectiveness. However, in advanced stage diseases where the life-expectancy ranges from days to weeks, this short period of palliation may also be of help.

In conclusion, TAE can be considered an effective and safe way of bleeding control in inoperable, advanced stage disease in uterine body cancer patients.

### Author Contributions

Conceptualization, S.J.H.; data curation, C.H.H.; formal analysis, C.J.; investigation, C.J.; methodology, C.J., S.J.H.; supervision, S.J.H., C.H.H.; validation, S.J.H.; writing—original draft, C.J.; and writing—review & editing, all authors.

### Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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## 자궁체부암 출혈에 대한 보존적 치료로서의 경카테터 동맥 색전술

최재연 · 신지훈\* · 추희호

**목적** 자궁체부암 출혈에 대한 경카테터 동맥 색전술의 효과와 안전성을 평가하였다.

**대상과 방법** 20년 동안 자궁체부암 출혈로 경카테터 동맥 색전술(transcatheter arterial embolization; 이하 TAE)을 시행 받은 여섯 명의 환자들의 자료를 후향적으로 수집하였다. 혈관조영술 및 단면 영상 소견, TAE의 세부사항과 임상 경과를 탐구하였으며, TAE의 기술적, 임상적 성공률(technical and clinical success rate)을 각각 계산하였다.

**결과** 환자군은 자궁내막양 선암종, 육종, 그리고 임신용모종양으로 이루어졌으며, 대부분이 말기 암 환자들이었다. 출혈은 네 명의 환자에서 질출혈로 나타났다. 여섯 명의 환자들에서 일곱 번의 TAE가 시행되었고, 모든 TAE 시술에서 기술적 성공이 달성되었다. 자궁절제술을 받은 두 명의 환자들에서는 골반강 내 재발한 종양의 출혈이 혈변으로 나타났고, 이 환자들에서도 TAE는 기술적 성공을 보였다. 임상적 성공률은 50%로 절반의 환자에서 일주일 이상 출혈 조절이 되었다. 재출혈은 한 명의 환자에서 사망과 직접적으로 연관되었다. 한 명의 환자에서 시술 다음 날 경미한 부작용이 있었다.

**결론** TAE는 자궁체부암 출혈에 대한 효과적이고 안전한 방법이며 특히 진행암, 말기암 환자들의 질병 경과 중의 위험한 시기에서 고려될 수 있다.

울산대학교 의과대학 서울아산병원 영상의학과